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ORTHOPÆDIC APPARATUS.

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ORTHOPÆDIC APPARATUS.

A SERIES OF

ILLUSTRATED PLATES,

WITH CORRESPONDING DESCRIPTIONS OF THE VARIOUS FORMS OF MECHANISM EMPLOYED IN THE TREATMENT AND CURE OF THE NUMEROUS DEFORMITIES OF THE HUMAN BODY.

BY

F. GUSTAV ERNST,

INVENTOR AND MANUFACTURER OF

Orthopædic and Anatomical Mechanism.

London:
1883.
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PREFACE.

ORTHOPÆDIC Apparatus being so numerous, and their mechanical arrangement having altered owing to the requirements occasioned by the continued progress in the science of Orthopædic Surgery, I have for some time past entertained the idea of placing before the medical profession a series of illustrated plates of the most improved and scientific apparatus, with a general description of their use and construction, so as to enable the medical man readily to see what apparatus are made for various deformities, and to determine which would be the most suitable for the case under his care, and, as far as practicable at present, I have carried out my intention in the following manual. It is obvious that this series cannot possibly represent every apparatus that may be found necessary for each deformity, every case having its own individual aspect, but it contains a selection of modern instruments only, such as are daily recommended and used by our most eminent surgeons, and which form the base of all apparatus. I have frequently had to combine the mechanism of two or three different instruments, to obtain the necessary help and support in cases of almost an isolated nature, such as that figured for "effecting supination of the fore arm," showing that, although no apparatus may here be mentioned for a case totally different to ordinary deformities, yet, by a skilful and judicious union of various movements, a suitable and perfect apparatus may be obtained.

In all my apparatus, I particularly study to make them as light as possible, consistent with the work they have to perform, and I attribute my success in making instruments that can be

worn with comfort and with ease, to the great care which I have always paid to the preliminary fitting whilst the metal is in the softened condition.

There are so many deflections, angularities, and prominences n the deformed human body, that it is nearly impossible to obtain a correct outline of these peculiarities, trusting to measurements and memory only. I therefore deem a preliminary fitting indispensable, except in those cases where a cast of the deformity can be obtained. This latter method is often resorted to, as in many cases, distance, health, and various other causes, prevent a personal interview.

I use steel for all my apparatus, because (by its peculiar properties) they can be made at least *two-thirds lighter* than if iron were employed. An instrument of steel, weighing, say 1½ lbs., will give greater support, and an infinitely greater amount of ease in wear, than one constructed of iron, which, to be equally efficacious, would weigh at least 3 lbs. or 4 lbs.; this, because the steel can be hardened so as to retain its shape, whilst a much larger quantity of iron must be used before the same object can be obtained.

In all my spinal apparatus I have long since discarded the old and straight pelvic band, which took its bearing on as low a portion of the pelvis as possible, and which I have often heard eulogized as a means of giving a longer back lever and a (supposed) greater support; but I need hardly point out that this is contrary to all mechanical laws; certainly, if a heavy weight is to be raised, then a long lever—and the longer the better—is indispensable, but where support, and if I may use the term, "shoreing up" is required, then the lever should be as short as possible, so as to give a greater amount of rigidity—a long lever is apt to bend and not support.

I have therefore invented the crescent-shaped pelvic band, which takes a firm bearing on the sacrum, and being combined with hip-pieces resting on the crests of the iliæ, encircles the pelvis, and gives the required fulcrum for support and pressure,

and I have found this form of pelvic band so satisfactory, that I have never reverted to the old shape. It has also the additional merit of entirely doing away with that "dragging down" sensation—so often a cause of complaint. I always keep in mind that there is a very great distinction between an instrument *supporting the patient* and the patient *supporting the instrument*. These latter cases frequently come before me, and are generally traceable to the old-fashioned and erroneous form of pelvic band. In many of the apparatus I find it better to use elastic insertions to allow of easy respiration, muscular movements, and full development. In fitting these apparatus, I take especial care that each shall be so closely adapted, as to be imperceptible through the dress.

The treatment of lateral curvature of the Spine by suspension and the application of Plaster of Paris bandages, according to Sayres' method, presenting several unpleasant features, inasmuch as the Jacket when once applied cannot be removed for ablution or examination of the affected parts. I (being actuated by this knowledge, and seeing the necessity for a superior material), perfected and introduced in 1878, the Poroplastic Felt Jacket, which I have now largely used with great success. As I have given in the pamphlet on Poroplastic Jackets, referred to in the manual, a full description of the mode of application, &c., I do not think I need state here more than a few of the advantages it possesses in comparison with the Plaster of Paris. Firstly, the application of the Jacket occupies but two or three minutes from the time of moulding till the Jacket is perfectly hardened. The great advantage to be derived from this rapid means of fixation are obvious, for the patient suffers very little fatigue by suspension, and the amount of extension gained by suspension is fully maintained when the patient is released from the apparatus. This, I consider its chief advantage, as it is well known of Plaster of Paris, that it does not set until at least twelve hours after the application. Secondly, the Poroplastic Jacket can be removed without in any

way affecting its rigidity or efficacy; this is most desirable in cases of lateral curvature of the Spine where a regular course of gymnastic exercises are undertaken, and also in cases of Pott's disease of the Spine, where an occasional thorough examination of the seat of the disease can take place, and attention be given to any abscess that may exist. Thirdly, the capability of the Jacket for constant remoulding is of material benefit in those cases of lateral curvature of the Spine where rapid progress is made by suspension. Fourthly, the weight and porosity of the Jacket render it extremely comfortable in wear.

With reference to the mechanism for the lower extremities, although I have introduced a great number of improvements in the details of joint construction, and in the shape of the side stems, so as to obtain the greatest amount of strength with the least possible weight, I do not think that any improvement can claim as much attention as that existing in the walking apparatus for paralysed and partially weakened muscles. The principal movements are the "gun lock" and "toe elevating" spring, which are a great extending and uplifting force, and which can be regulated to give the exact amount of help where the muscles are partially or entirely devoid of power. The "gun lock" spring is used successfully in cases where there exists paralysis of the anterior muscles of the thigh, and it possesses the great advantage of permitting free movement to the joint, and at the same time giving an efficient support, and preventing that tendency to collapse which forms a feature in the cases of persons so afflicted. Although the "ring catch" joint gives the same amount of firmness and support, yet it is obtained at the expense of immobility. The "toe elevating" spring is another important factor in a large number of cases, where slight or entire paralysis of the anterior muscles of the leg exists. Its action is automatic, as will be seen by reference to the description of the figured illustration, but I might here say that it is of incalculable benefit to adults in advanced years, where locomotion is rendered difficult, and in some cases almost impossible, by the loss of natural power.

These springs have been devised to supersede the elastic tendons, with the additional advantages, firstly, that once set to the required power, they cannot possibly stretch or yield; secondly, they are, from their construction, exceedingly compact, no projecting lever (as in the elastic tendon) being required as a fulcrum; thirdly, from their compactness they in no way show or disfigure the dress; fourthly, by the addition of the rack arrangement, as in the figured illustration, the power can be increased or diminished to a far greater nicety then by the elastic tendon.

A great many ingenious plans have been devised to facilitate the removal of the boot from the walking instrument without removing the whole apparatus, and also to permit of a night shoe being attached to the same instrument in order that certain kinds of treatment may be continued uninterruptedly, both night and day. Some have been very simple, such as the "socket" attached to the heel of the boot, and the "keyhole catch" disconnection; but the former readily corrodes by the accumulation of wet and dirt in walking, and the latter very soon wears out owing to the limited working surface of the joint. The most durable and fixed form of detachment is the "bevelled morticed joint," which in no way interferes with the working of the ankle-joint, but is a detachment above the ankle, fixed or released by a sliding ring. The fitting is very accurate, and there being no friction, it cannot possibly wear loose.

Arm apparatus as a rule require some complicated form of mechanism, which generally consists in a combination of movements already known, but a very efficient and new form of retentive splint will be found in the illustrations of apparatus for Dupuytren's contraction, viz., the Pistol, Palmar, and Beattie Splints.

Nose apparatus have also been greatly modified and improved within the past few months; the clamp at present used, in addition to the improved shape of the ivory plates, is fitted with a screw stop movement to prevent over-screwing when it is inserted.

Although trusses are such a common apparatus, I must draw the attention of medical men to one form, viz., that of Dr. Dick, which has in many and peculiar cases been found very successful where other forms have failed. This I consider due to the auxiliary spring, which acts directly in an upward and supporting direction, and is entirely independent of the main spring, which simply serves to keep the pad in position.

From time to time various most ingenious forms of artificial limbs, and of movements connected therewith have been brought forward, and many of them display great skill and ability in their construction and close resemblance to the articulations of human limbs; but they are all open to this objection, that, owing to the difficulty and care required in their use, they prove rather a burden than a help. This arises from the fact that the space occupied by the mechanism is so small that free scope cannot be given to the movements which loose by limitation. Influenced by this knowledge, I have carefully constructed all my artificial limbs on the simplest principle with a view to obtain the greatest benefit with the least complicated mechanism. The tendon arrangement in my artificial legs assimilates as much as possible with the insertion of the tendo achilles in the human limb, and its action is exactly the same. With reference to the limbs for the upper extremities, I find again that the simpler the mechanism the more useful the apparatus. I have given a detailed description, with the illustrations, of the various limbs, and therefore further comment here is unnecessary.

Of late years Gymnastic apparatus have been very prominently brought forward and employed in the treatment of certain forms of spinal deflection. In the second part of this Manual, I give a detailed description of my "Portable Gymnasium," with a list of exercises and directions how to perform them; but here I would call especial attention to the "Exercising Plane," for lateral curvature in the commencing stage. This I invented at the request of Mr. Adams in the beginning of last year, and it has proved highly efficacious in a large number of cases. The illustrations and description will give a general

idea of its use. The trapèze bar I have also altered, so that it can, by a simple sliding arrangement, be adapted to the height of any patient or room.

This Manual does not include all the special exercising apparatus that I make, such as those required for the joints of the upper and lower extremities. The cases to which I refer are isolated; and to provide duplicates of such special apparatus would entail an enormous expense, and burden one with an unknown amount of useless contrivances.

I am also precluded from giving any illustrations of the adscititious aid I frequently supply for the defects of nature, as there naturally exists on the part of patients a very great antipathy to having their cases photographed.

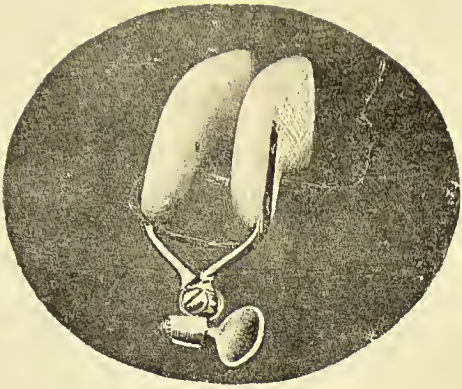
The large use that has been made of my apparatus constrains me to offer my sincere thanks to the great number of medical gentlemen who have with such kind confidence entrusted their cases to my care, and if this Manual carries out my intention of helpfulness in every way, I shall feel fully recompensed.

F. GUSTAV ERNST.

80, Charlotte Street,
Fitzroy Square, London, W.
1883.

I THINK IT WELL TO MENTION THAT THE COST OF EACH APPARATUS IS MADE IN ACCORDANCE WITH THE AMOUNT OF TIME AND LABOUR OCCUPIED IN ITS CONSTRUCTION AND ADAPTATION. AS EVERY CASE REQUIRES ITS OWN SPECIAL APPLIANCE, IT IS IMPOSSIBLE TO MAKE A FIXED PRICE FOR EACH INSTRUMENT.

ALL THOSE APPARATUS WHICH ARE SUPPLIED TO HOSPITAL PATIENTS, HOSPITALS, INFIRMARIES, DISPENSARIES, &C., ARE CHARGED AT THE COST OF LABOUR AND MATERIAL ONLY.



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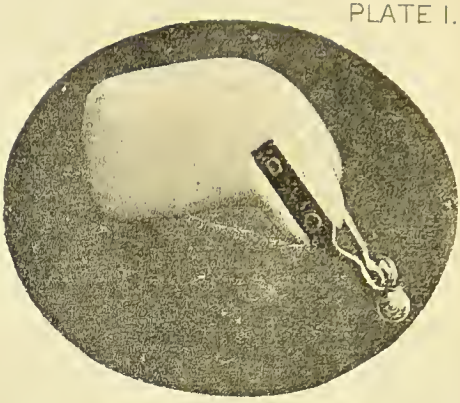

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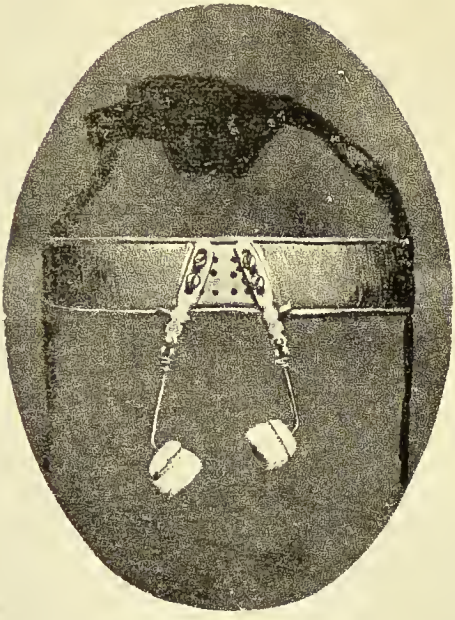

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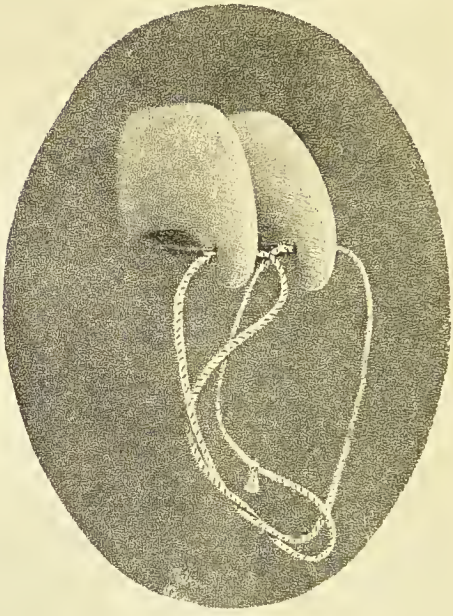

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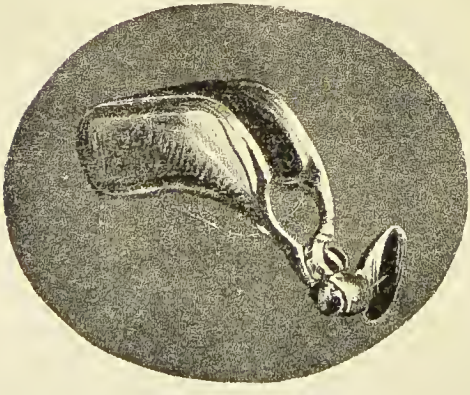

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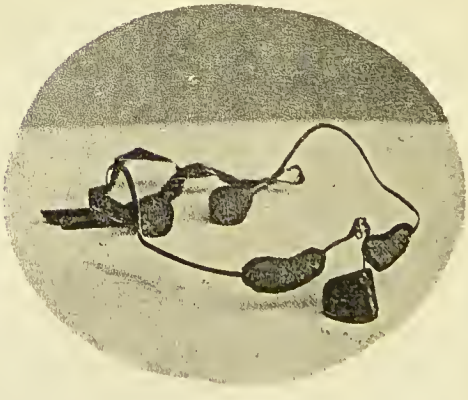


FIG 6.

Fig. 1.—Nose Truss.—(For use after operation for broken nose.) Employed and recommended by Mr. Adams. This apparatus consists of a forehead band as fulcrum, with two double-action rack and pinion movement levers, the lengths of which are regulated according to the curve of the nose, whether to the right or to the left. The pressure plates are attached to the ends of the levers by a ball and socket arrangement, and covered with a piece of soft felt, thus permitting the most perfect adjustment and an equal pressure.

Fig. 2.—Nose Clamp.—(For use directly after operation.) Employed and recommended by Mr. Adams This apparatus consists of two ivory plates connected by a screw movement at the base, with a limited range of motion to prevent overscrewing. The ivory plates are either separately convex or concave, according to the direction of the curved septum.

Fig. 3.—Nose Clamp.—Side View.

Fig. 4.—Nose Clamp, in Metal.—Occasionally used in the latter stages of treatment to diminish obstruction of the nostril, and allow greater freedom in breathing.

Fig. 5.—Nose Plugs.—Occasionally used with the Nose Truss in place of the Clamp. These are applied either singly or together, and made the same shape as the ivory plates of the Clamp, separately concave or convex.

Fig. 6.—Light Apparatus for Crooked Nose.—This apparatus is constructed to be worn at night, to cure any slight deviation of the nose from the median line.

Fig. 7.—Retentive Apparatus for Cases of Prominent Ears in Children.—This consists of a light spring, to the ends of which small plates are attached to reduce the abnormal projection of the ears.

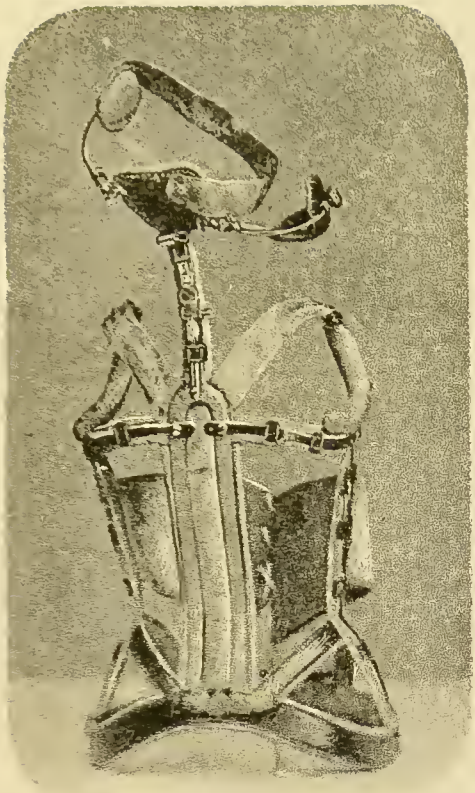
APPARATUS FOR SPINAL AFFECTIONS.

(*a*) WRY NECK.

Fig 8.—Wry Neck Apparatus.—Introduced and recommended by Mr. Adams. This instrument consists of a light spinal support as fulcrum, the back lever terminates at the top by a neck piece extending to the base of the occiput, in which piece is contained three rack and pinion movements: No. 1., lateral; No. 2., flexion and extension; and No. 3, rotation. To the end of this stem is attached a metal occiput plate, from which two levers, both with double action, rack and pinion movements, are extended, one to the side of the forehead with a forehead plate, the other to the side of the lower maxillary with a chin plate, both the forehead and chin plates are adjustable by swivel screw movements; the double action levers attached to the occiput plate are only for the adjustment of the forehead and chin plates, the head is gradually brought into its normal position by the three movements in the neck stem.

Fig. 9.—Poroplastic Cuirass with Wry Neck Attachment.—The mechanism of this apparatus is the same as that used in Fig. 8, the poropolastic being substituted as fulcrum, for the spinal arrangement. This form of fulcrum may also be used with a head-piece for disease of the cervical vertebrae, see Fig. 27, Plate 7.

Fig. 10.—Leather Collar for Wry Neck.—This is blocked or moulded accurately to the neck, supports the head and checks the contracting tendency of the muscles of the neck. It is particularly suitable for slight cases.



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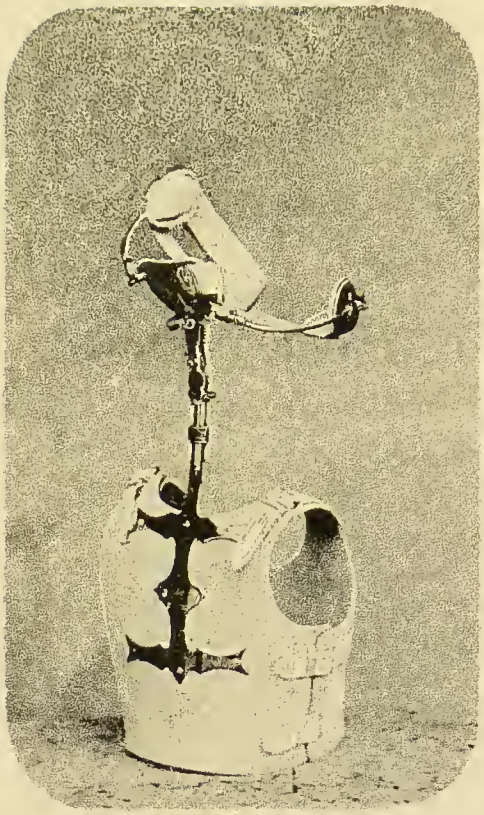

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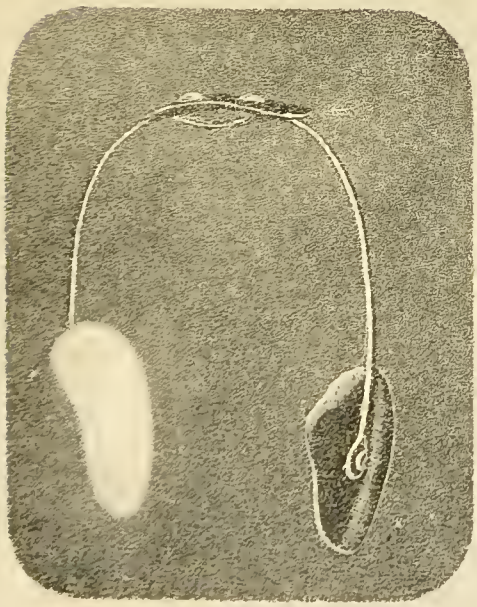

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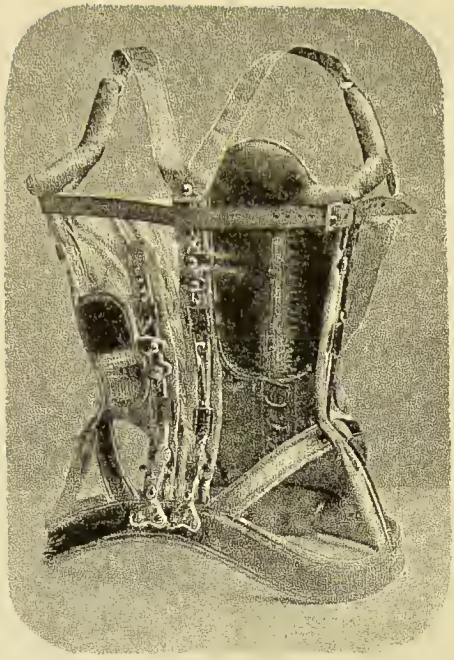

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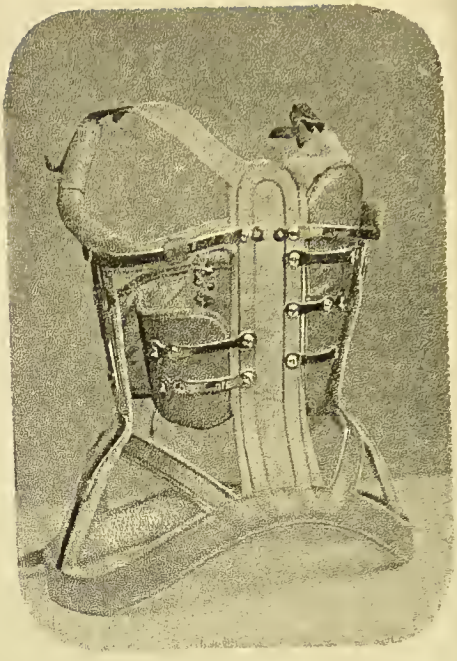

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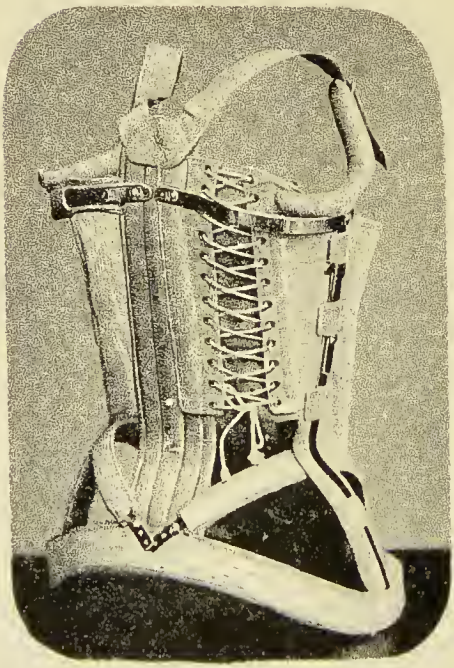

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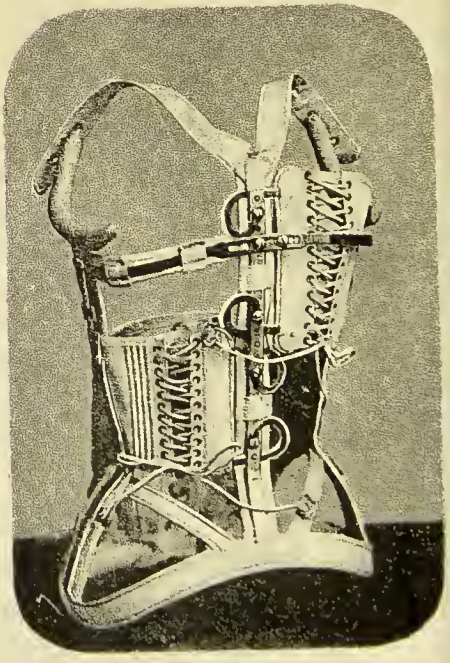


FIG 14.

(*b*) LATERAL CURVATURE OF THE SPINE.

Fig. 11.—Spinal Apparatus with Moveable Levers.—This diagram represents an apparatus for the cure of double lateral curvature, with the long curve on the right and the short curve on the left side. There is a double action rack and pinion arrangment to each lever, effecting a lateral and forward movement; the size and position of the plates are varied according to the case. In long single curves only one lever and plate being necessary.

Fig. 12.—Retentive Spring Plate Spinal Apparatus. Introduced and recommended by Mr. Adams. This apparatus, as its name implies, is only used in cases where retention of a curve and slight improvement only can be effected. The spring plates can be adjusted in the first instance to give the required amount of support and pressure, which is always maintained. This apparatus is very suitable for rotary-lateral curvature, as the action of the springs gives a direct counter-rotary movement.

Fig. 13.—Spinal Apparatus with Laced Shields.—An adjustable apparatus for simple lateral curvature. The laced shields are attached to the back lever and side crutches, and when the apparatus is applied, the laced parts are firmly tightened to give the necessary pressure and support.

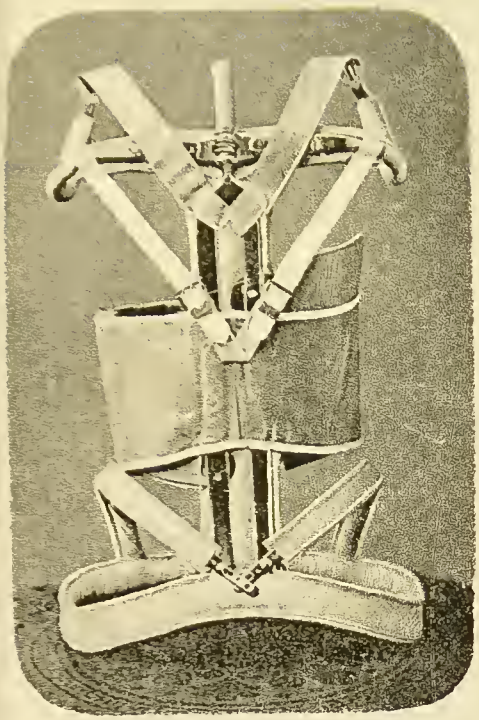
Fig. 14.—Spinal Apparatus with Combined Spring Plates and Laced Shields.—This apparatus combines the action of the spring plate and laced shield, and is very suitable for rotary-lateral curvature; the object of the small spring plate, which extends the whole length of the curve, is to press on the transverse processes of the vertebræ, so as to counteract rotation, the laced shield correcting the lateral deviation. This instrument is capable of being adjusted as the case progresses. In severe forms of curvature, an angular lever is attached to the crutch on the side where the long curve is situated, so as to increase the size of the laced shield and give greater support.

Fig. 15.—Spinal Apparatus (*back view*).—Employed and recommended by Dr. Little. The principal feature of this apparatus consists in the construction of the arm pieces, which are regulated by an adjustable screw movement at the top of the back lever, enabling them to be raised correspondingly to the growth of the patient and straightening of the spinal column, thus obviating the use of side crutches. The plates for lateral pressure are connected directly with the back lever.

Fig. 16.—Spinal Apparatus (*front view*).—Shewing position of arm pieces and pressure plates of preceding figure.

Fig. 17.—Spinal Stays.—Employed and recommended by Mr. Adams. The special feature of these stays consists in the steel supports at the back, which embrace half the scapulæ, take their bearing on the sacrum, and by the crutch continuations under the arms with elastic shoulder straps, give an efficient support. These stays are generally used in connection with the trapèze bar, Fig. 114, and are very useful in cases of slight spinal curvature.

Fig. 18.—Spinal Stays.—As the illustration represents, these are adaptable for severe cases of lateral curvature of the spine, and are very suitable for patients with confirmed curvature, especially those in advanced years. The support is derived from crutches at the sides, and a transverse strap passing over the lateral projection. The stays are fitted with elastic insertions in front to prevent undue compression, and admit of free respiration.



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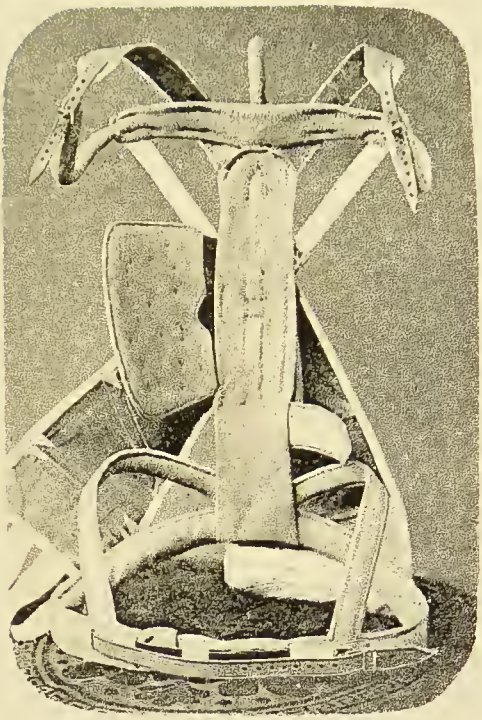

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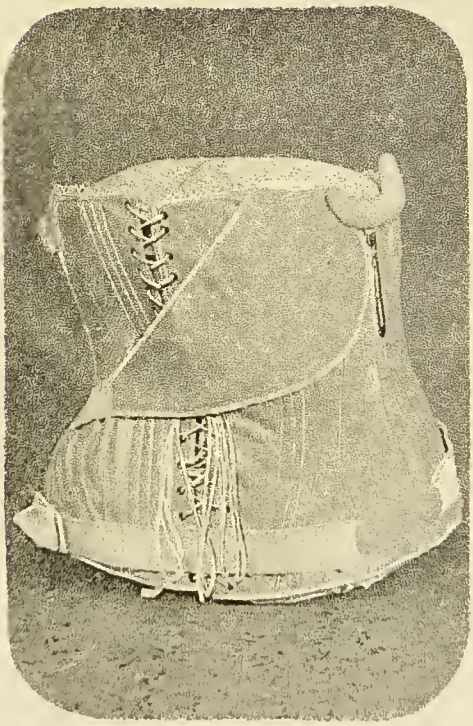

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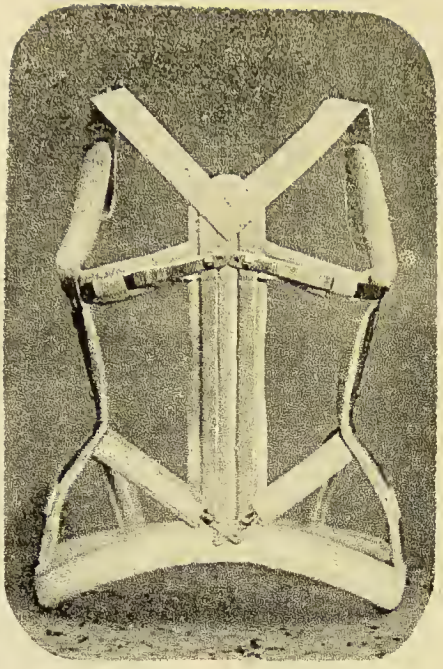

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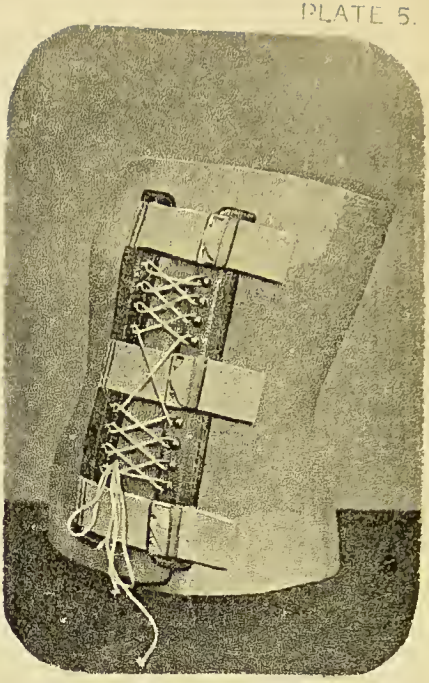

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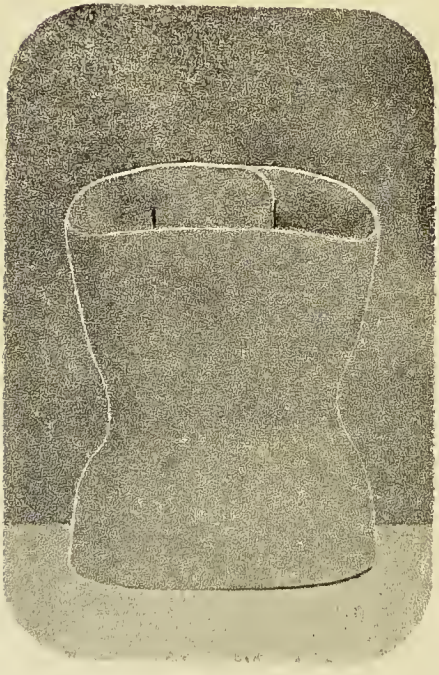

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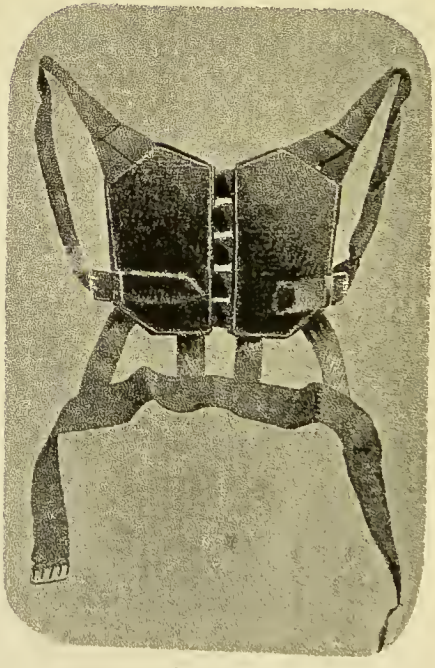


FIG 22.

Fig. 19.—Very light Apparatus for Spinal Weakness and general Muscular Debility.—This apparatus, though simple in form, is very efficacious. It consists simply of the crescent shaped pelvic band, with hip pieces, double back lever and side crutches. The instrument can be readily adjusted to give an easy and general support.

Fig. 20.—Poroplastic Jacket.—(*front view.*) This jacket, composed of felt, impregnated with various gums, has been invented to supersede the plaster of paris jacket, and is applied in a similar manner during suspension. It is very easily adapted, very clean, and ensures immediate fixation before the patient is released from suspension. A pamphlet describing the mode of adaptation and giving detailed particulars can be obtained on application to Mr. Ernst.

Fig. 21.—Poroplastic Jacket.—(*back view.*)

(*c*) POSTERIOR CURVATURE OF SPINE.

Fig. 22.—Elastic Shoulder Braces.—For ordinary posterior curvature or round shoulders. They consist of metal scapulæ plates with arm straps to draw the shoulders back; the waist band prevents any tendency to "riding up" and keeps the plates in position.

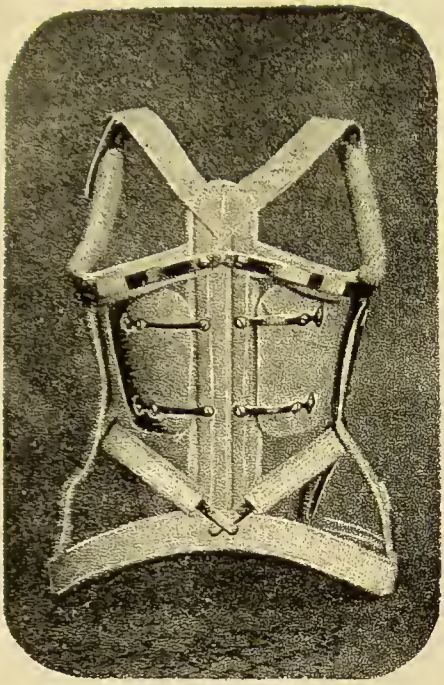
Fig. 23.—Spinal Apparatus with Equal Spring Plates.—A similar apparatus to that used for lateral curvature, Fig. 12. The supporting plates are of an equal size, and placed opposite each other on either side of the back lever. This instrument can also be used very efficiently in cases of general debility.

Fig. 24.—Spinal Apparatus with Convex Spring Back Lever.—A spinal apparatus, with light steel spring curved with the convexity towards the posterior curvature. This apparatus is very light, and affords great supporting power.

Fig. 25.—Back Board for Children.—This light apparatus is generally used to counteract any tendency to posterior curvature in Rachitic children. It consists of a very softly padded back part, to which is attached axillary and perineal straps, from which the necessary support is obtained.

(*d*) POTT'S DISEASE AND ANGULAR CURVATURE OF THE SPINE.

Fig. 26.—Poroplastic Jacket for Angular Curvature.—Similar to that made for lateral curvature, Fig. 20, Plate 5, but having the part over the prominent spine at back left quite soft, to avoid undue pressure and abrasion of the skin.



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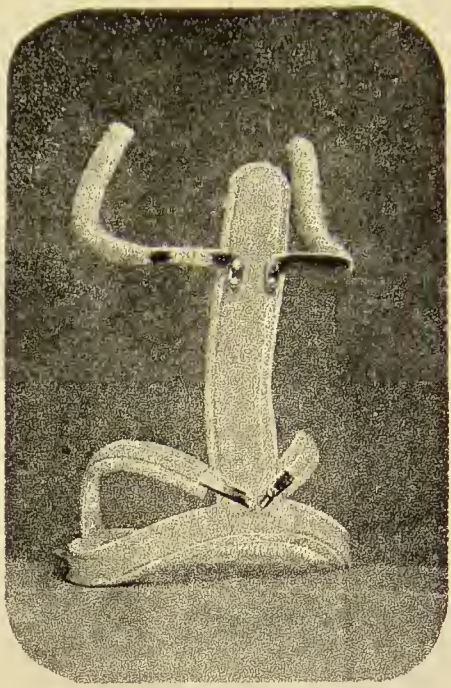

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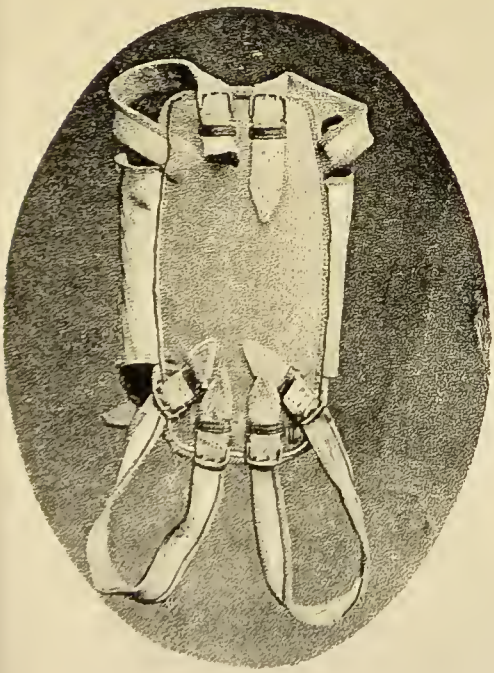

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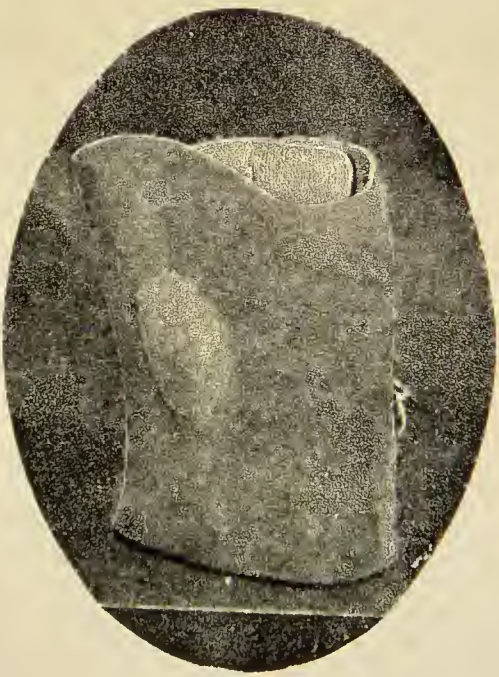

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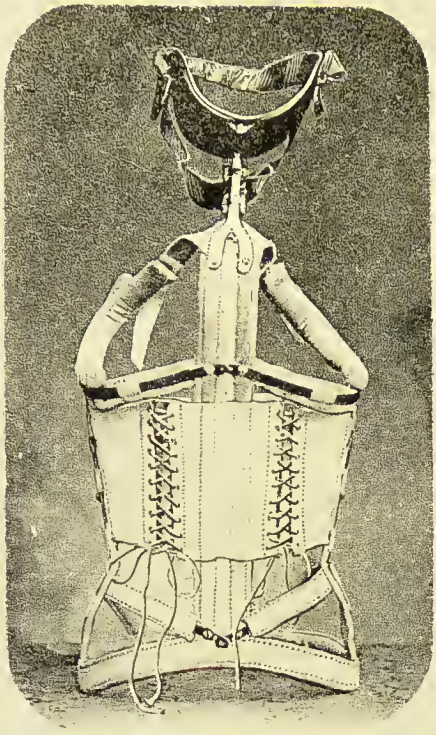

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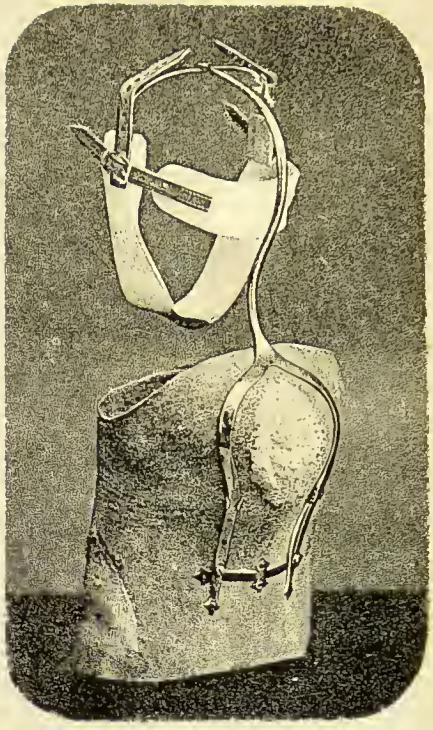

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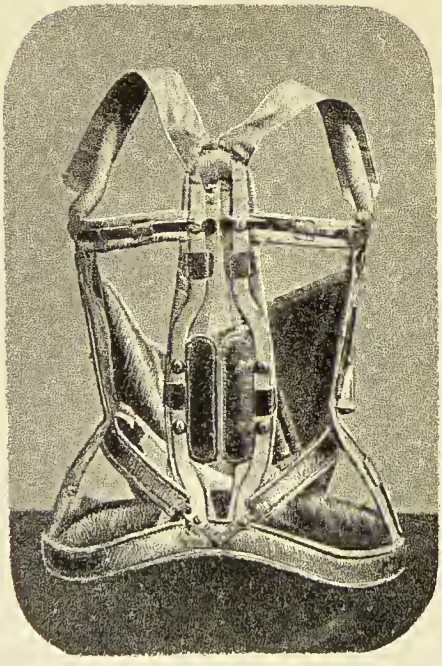

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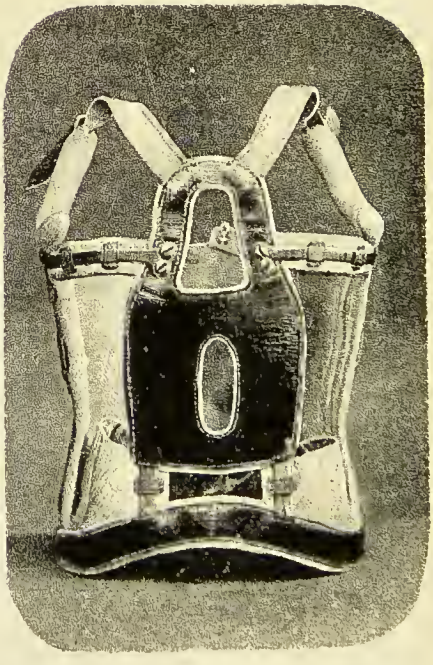


FIG 30.

Fig. 27.—Spinal Apparatus with Head Piece for Disease in the Cervical Region.—This apparatus has a light spinal part as fulcrum. To the top of the back lever a head piece is attached for the purpose of transmitting the weight of the head to the pelvis. A swivel movement is added to the upper end of the neck piece to allow of lateral motion (if necessary), but this can be regulated by a "set" screw. The head piece is made detachable from the top of the back lever. The position of the axillary strap is an essential feature.

Fig. 28.—Poroplastic Jacket with Jury Mast.—Showing the method of adapting a jury mast to the poroplastic jacket. The head strap is of Mr. Ernst's pattern, the same as that used in the Sayre's improved suspension apparatus.

Fig. 29.—Spinal Apparatus with small Spring Plates.—This apparatus is devised for use after the cure of Pott's disease. The spring plates in the back lever are adapted to give a light and easy support to the affected part. Both this and the following figure are suitable and can be adapted to curves in the dorsal and lumbar region.

Fig. 30.—Spinal Apparatus with Leather Covering.—An apparatus similar in construction to the preceding figure, but having, in place of the small spring plates a leather shield, which gives a greater surface of support. A small aperture in the shield obviates direct pressure on the extreme prominence of the vertebræ.

Fig. 31.—Leather Cuirass.—Introduced and recommended by Mr. Adams. Consists of a blocked leather spinal part, with elastic connections in front so as to admit of free respiration, adjustable crutches are attached to the sides to give greater support. The leather is moulded to a plaster cast of the patient's back, thus ensuring a perfect fit.

Fig. 32.—Strong Spinal Belt.—Made of moleskin, jean, or webbing, and stiffened by whale bone and steel. It is used after the cure of Pott's disease, or in cases of spinal weakness.

Fig. 33.—Bed Frame for Children.—Introduced and recommended by Mr. F. R. Fisher. This simple arrangement is used to ensure perfect recumbency in cases of Pott's disease, and to prevent movement of the body in applying weight extension to the lower extremities. The child lies in the centre of the frame, the top part of which is buckled to the head of the bed, the child's arms at the axillæ resting in the crutches. A bandage is fastened to one end of the frame, passed under the bed, and securely fixed to the other end of the frame. This arrangement prevents any possibility of movement.

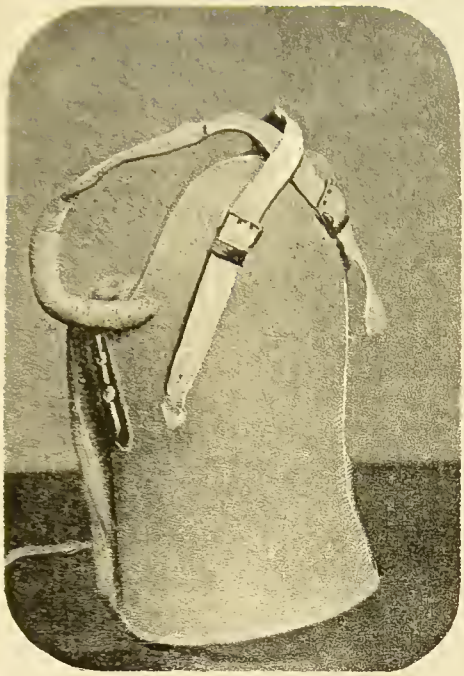
APPARATUS FOR PROMINENT STERNUM.

Fig. 34.—Sternal Compress.—Employed and recommended by Mr. F. R. Fisher, for the relief and cure of prominent sternum. This apparatus consists of a poroplastic back-piece, with abdominal belt and a softly padded metal ring, which is placed over the prominent sternum and retained in position by lateral straps attached to the poroplastic back-piece.

APPARATUS FOR UPPER EXTREMITIES.

Fig. 35.—Apparatus for Supporting Paralysed Arm.—The principle of the "gun lock" spring is here brought into play in conjunction with the centrifugal spring, and by their combination a very elastic force is gained. The fulcrum of the apparatus is obtained from the shoulder-piece, securely fastened under the axillæ, the arm-piece is then brought down and attached to the upper part of arm.

Fig. 36.—Apparatus for Paralysis of the Wrist Joint without contraction of Tendons.—This instrument consists of a plate encircling the forearm to which the hand plate is attached by uplifting springs.



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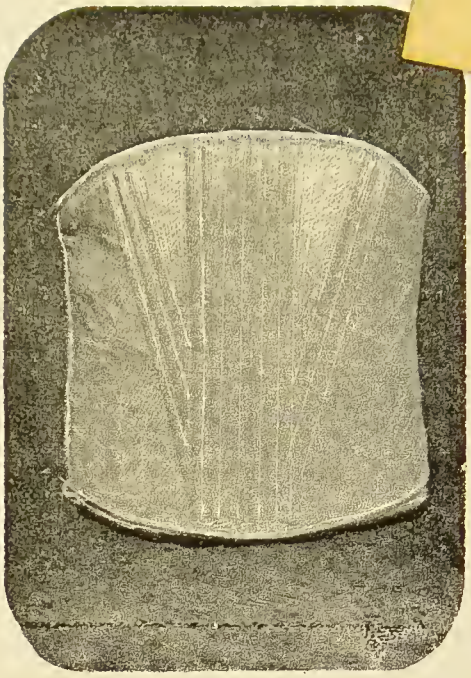

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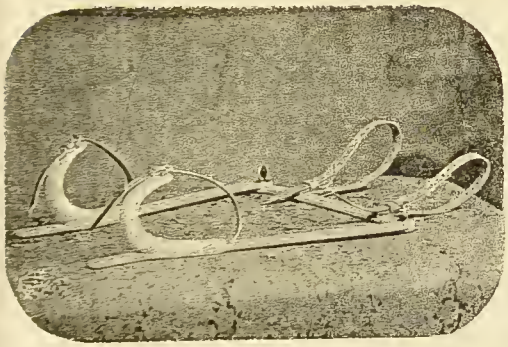

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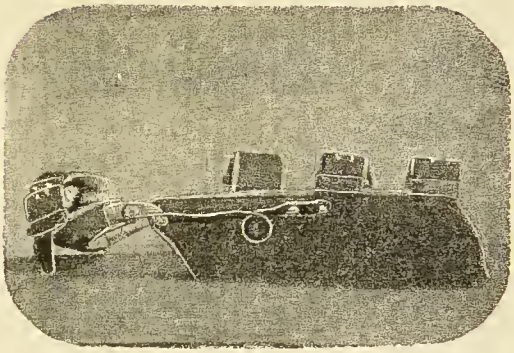

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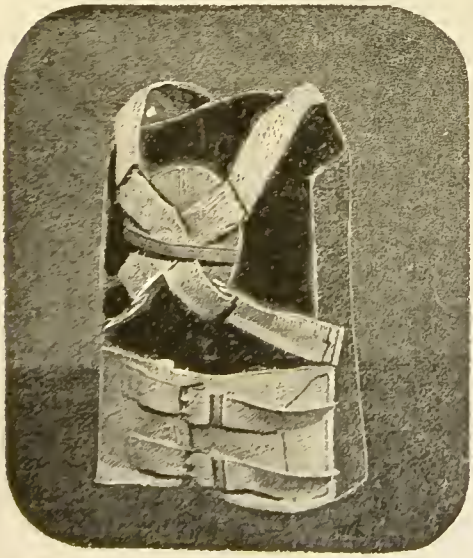

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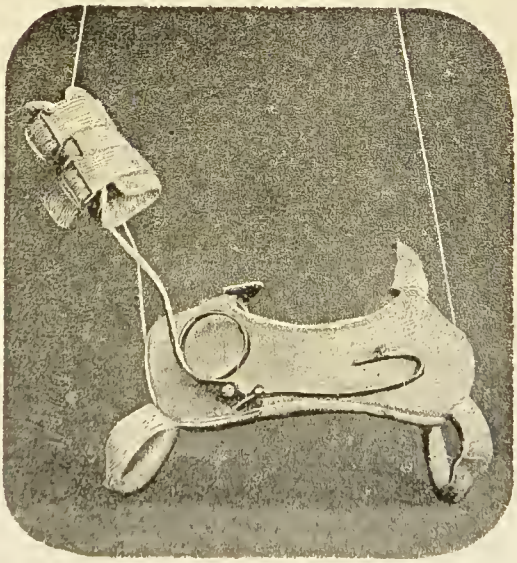

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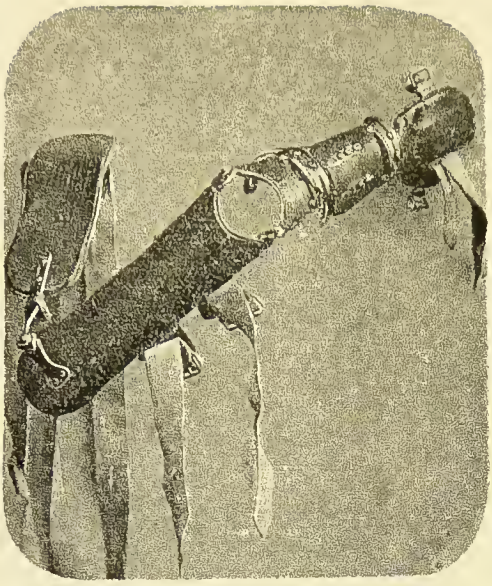

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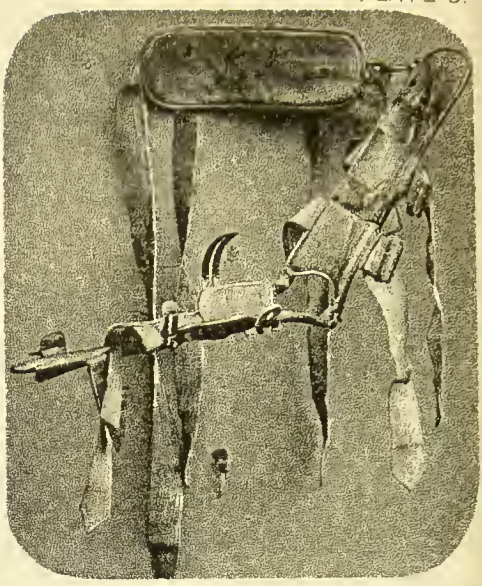

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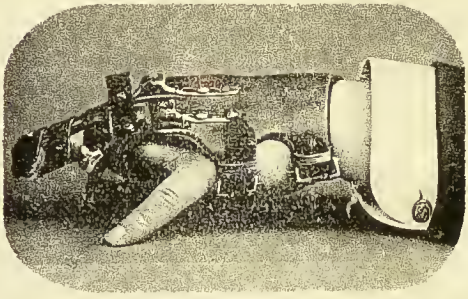

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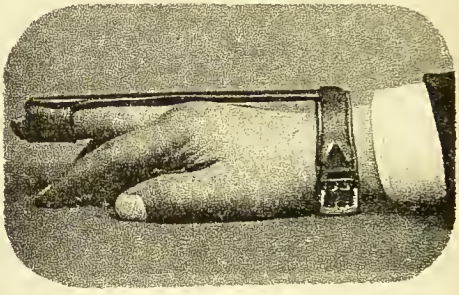

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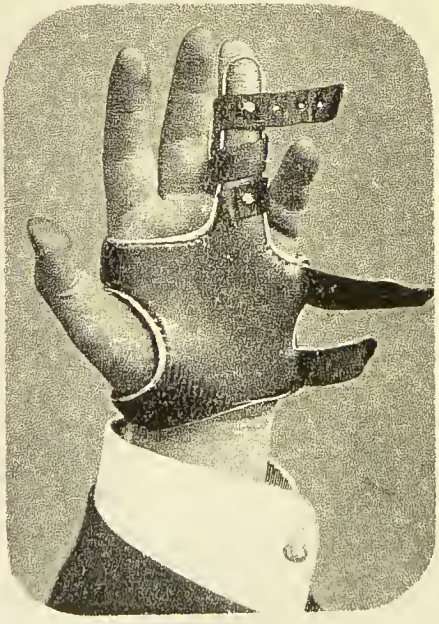

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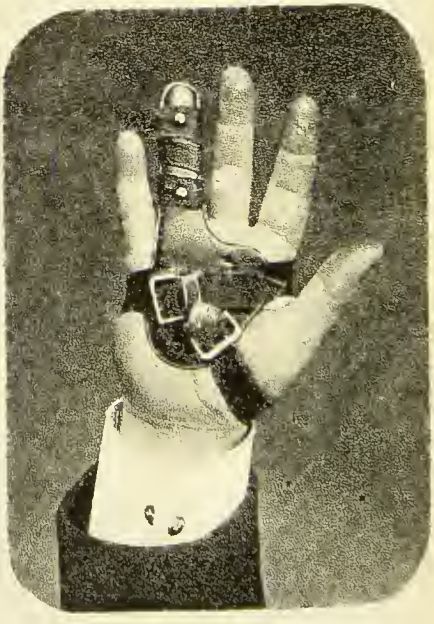


FIG 41.

Fig. 37.—Apparatus for effecting the Supination of Fore-arm and Outward Rotation of Arm.—Employed and recommended by Dr. Little. This apparatus consists of a back or metal piece as fulcrum, with a ball and socket movement at the shoulder joint, fixed by a "set" screw to prevent rotation. Extension of the elbow joint is made by a rack and pinion movement. The supination is effected by two divisions of the fore arm plate with rotation ratchet movement.

Fig. 38.—Apparatus as above. Side view.

Fig. 39.—Apparatus for Dupuytren's Contraction of Fingers. —(For use after division of the palmar fascia). The mechanism of the ordinary rack and pinion movement is adapted according to the number of fingers and joints involved. The hand plate is fitted in a manner that ensures freedom from pressure on the knuckles during treatment.

Fig. 40.—Palmar Splint. — Employed and recommended by Mr. Adams. A retentive splint for night wear after cure of contraction, to be used on the inside of the hand.

Fig. 41.—Pistol-shaped Splint.—Employed and recommended by Mr. Adams. A modification of the palmar splint for slight cases ; suitable for one finger only.

Fig. 42.—Beattie's Splint.—A long splint for one finger only, worn on the back of the hand.

Fig. 43.—Apparatus for contracted Elbow-Joint and Wrist-Joint, with Rotation at Wrist.—The extension is effected at the elbow and wrist-joints by rack and pinion movement, rotation above the wrist by ratchet movement.

APPARATUS FOR LOWER EXTREMITIES.

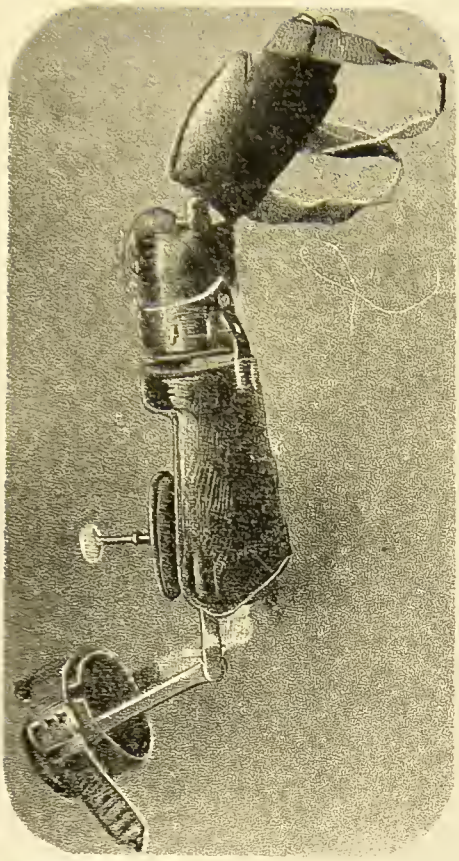
(*a*) HIP JOINT.

Fig. 44.—Blocked Leather Hip Splint, for use in Diseased Joint.—A leather splint, carefully blocked and softly padded, taking a firm grip of the pelvis and thigh, and thus preventing motion in the joint.

Fig. 45.—Sayre's Long Hip Splint.—This apparatus consists of a pelvic band, to which is attached a rod on the outside, with a platform joint at the hip, lateral screw and rotation movement below at thigh, extension arrangement below knee, and counter extension by perineal bands attached to pelvic belt. The lower part can be attached to a boot by a socket arrangement, enabling the splint to be worn during the day. An improvement has been made in this splint by the addition of a "ring catch" joint at the knee, by which means the joint can be flexed or fixed at will.

Fig. 46.—Thomas's Splint.—A splint adapted to the contour of the sound limb, and then bandaged to that with the diseased joint.

Fig. 47.—Thigh Bandage and Gaiter. (For use singly or together in weight extension.)—By their combination the strain on the leg is diffused, and the weight acts more directly on the affected hip-joint. The gaiter can be used singly for extension of knee-joint.



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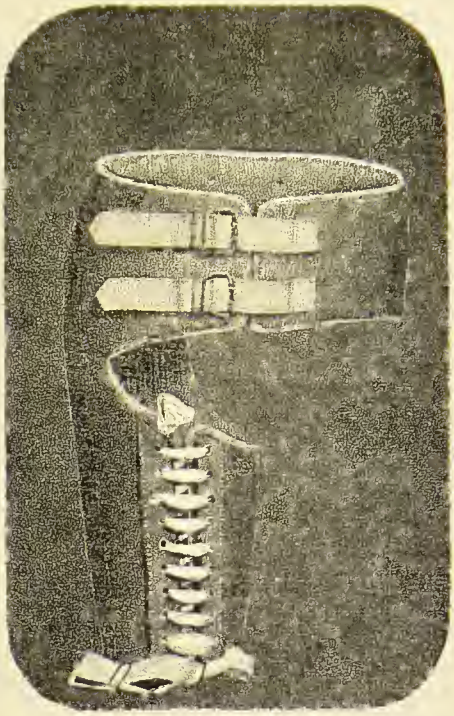

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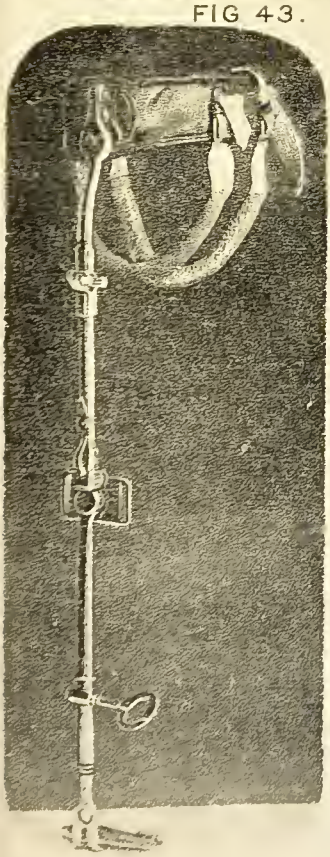

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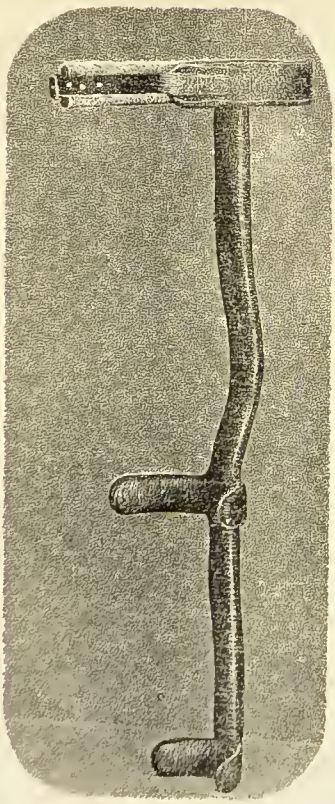

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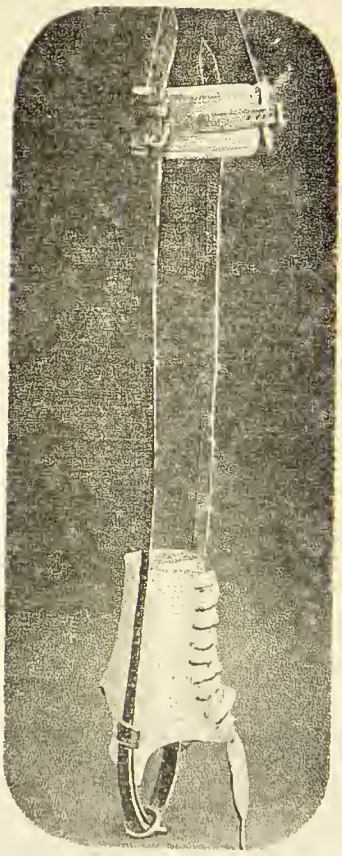

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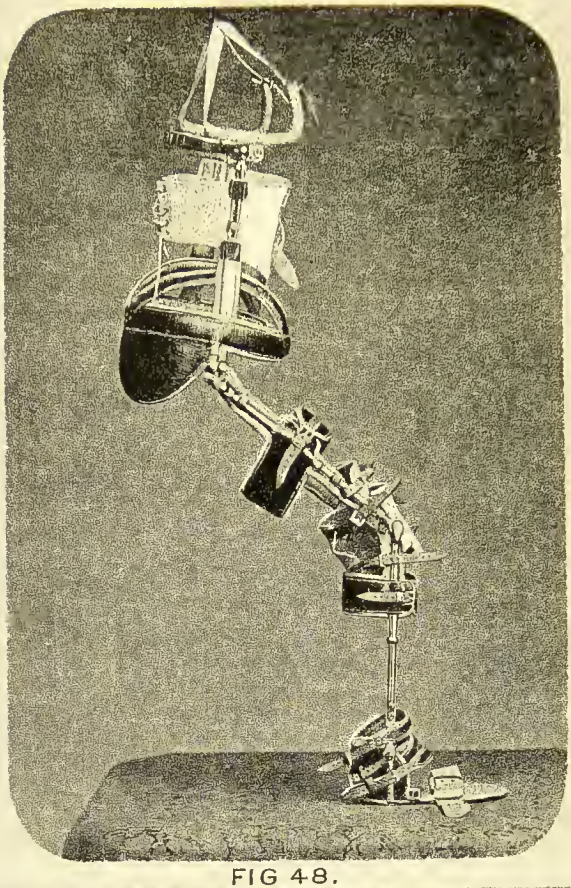

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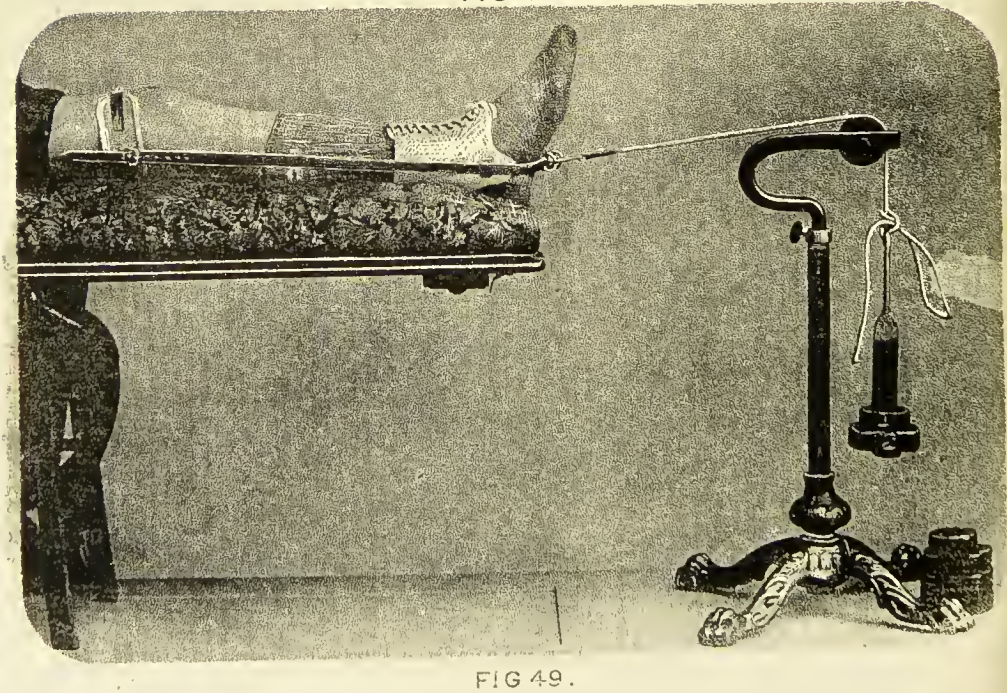


FIG 49.

Fig. 48.—Apparatus for contracted Hip-Joint.—The mechanism of this apparatus consists of three rack and pinion movements at the hip,—No. 1, lateral; No. 2, flexion and extension; and No. 3, rotation. The apparatus is carried to the axillæ by light crutches, to obtain the necessary fulcrum, and extended to the foot by an outside steel stem, terminating in a metal shoe, or ordinary walking boot. The lateral steel has a free joint at knee and ankle, with a sufficient number of encircling straps to retain the leg in proper position, and give the necessary leverage; sacral plates are attached to the pelvic band to give greater fixation on the pelvis.

Fig. 49.—Weight Extension Apparatus (Ernst's Pattern.)—(Showing method of adaptation of weight extension.) The thigh bandage is fastened above the knee-joint, the gaiter is applied to the foot, both straps from the thigh bandage are passed through the ring attached to the gaiter straps; these are then hooked to the cord passing over the pulley of the weight stand, and fastened to the weight-carrier with the weights. The weights are easily detachable, and consist of one 4-lb., two 2-lb., and two 1-lb. weights.

(*b*) KNEE JOINT.

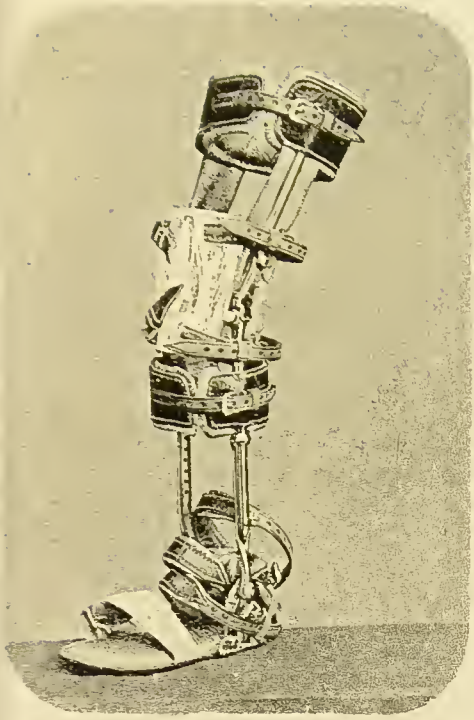
Fig. 50.—Apparatus for Contracted Knee Joint with Double Action Movement.—For cases of contracted knee with inversion, a double-action rack and pinion movement is used at the knee joint, the apparatus extends from the thigh to the ground, and is made with a detachable joint at the ankle, in order that either a boot or metal sole plate can be attached, so that the instrument may be worn day and night.

Fig. 51.—Apparatus for Slight Contraction of Knee with Spiral Springs.—A light apparatus extending from four or five inches above and below knee, with movement coinciding with the knee joint. The extension is regulated by spiral springs passing over the joints of the apparatus, and always maintaining a certain amount of tension. This apparatus can also be used successfully in slight cases of paralysis, sprain, or ligamentous weakness.

Fig. 52.—Mr. Ernst's Apparatus for Backward Dislocation of Head of the Tibia with Contraction of Knee Joint (*front view*).—In this instrument, the mechanism, viz. : that of a long screw working in a quadrant movement, corresponds exactly to the arc described by the head of the tibia in backward dislocation. The rack movement is the ordinary double action, with compensating movement inside.

Fig. 53.—Mr. Ernst's Apparatus as above (*side view*).—Shewing extreme action of quadrant movement.

Fig. 54.—Blocked Leather Splint for Diseased Knee Joint.—Moulded in a similar way to that for the diseased hip, Fig. 44 This Splint can also be made in Poroplastic.



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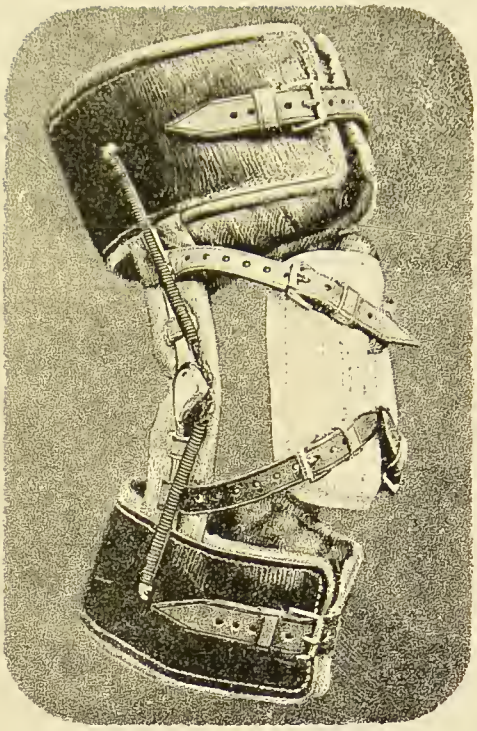

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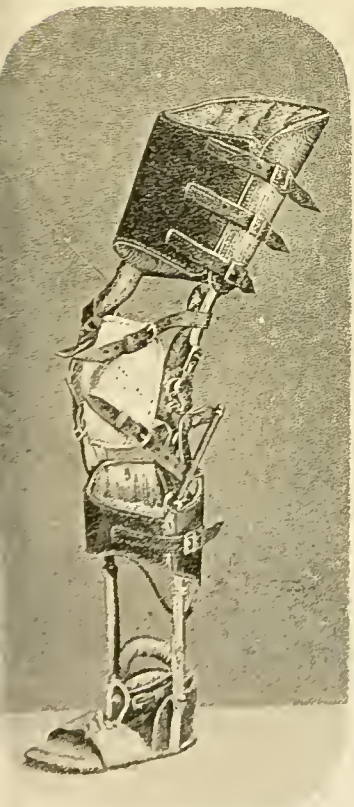

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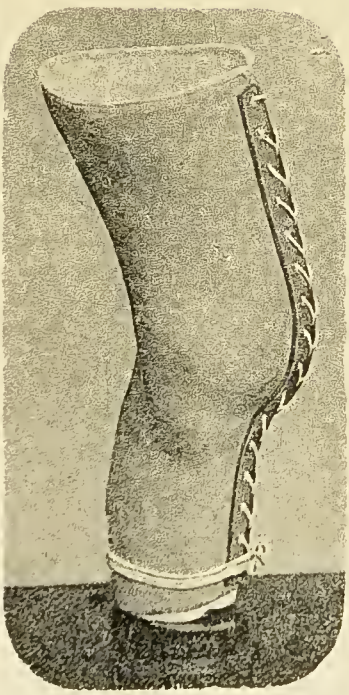

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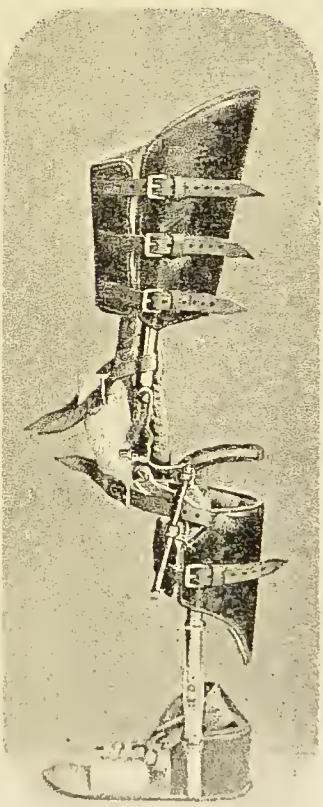

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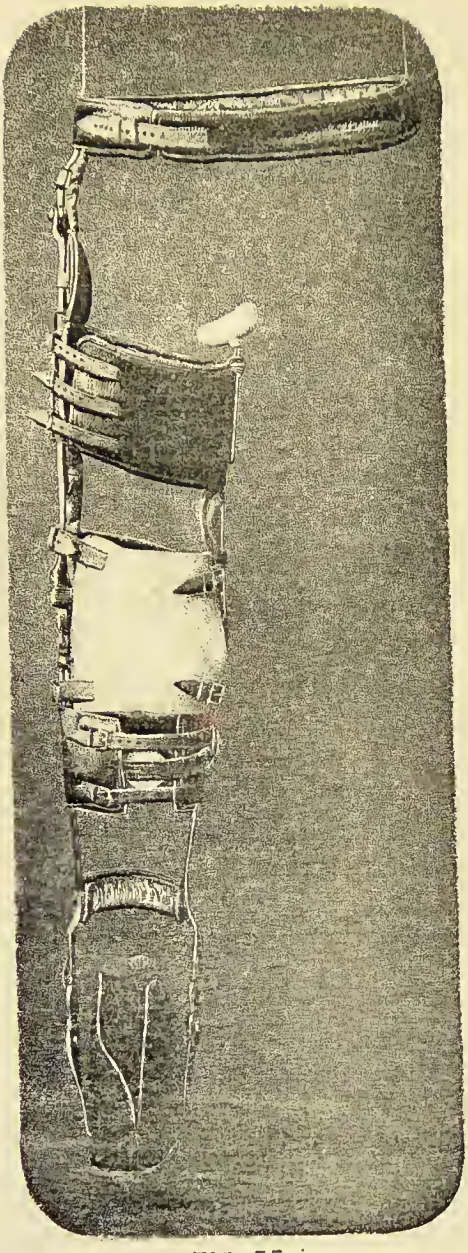

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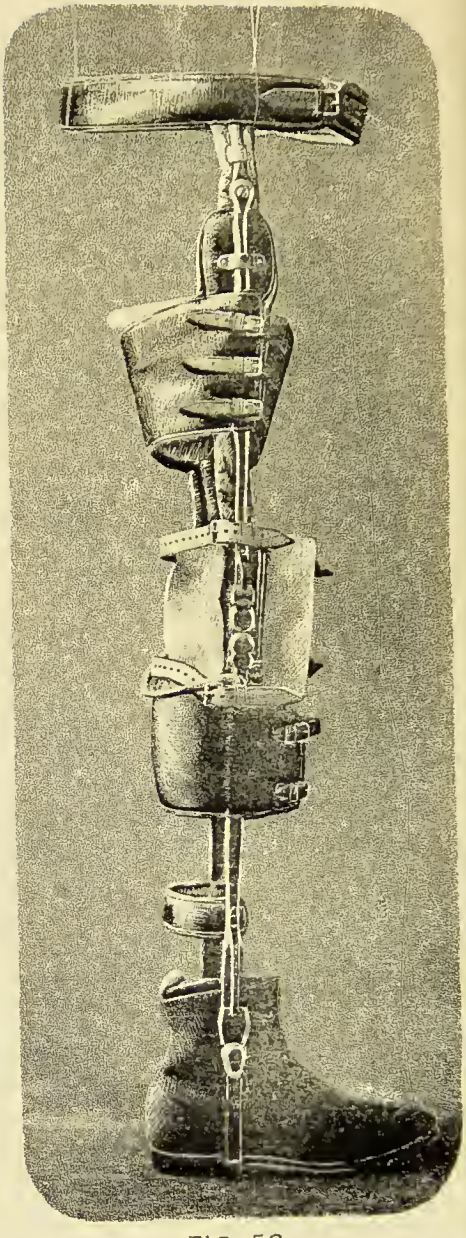

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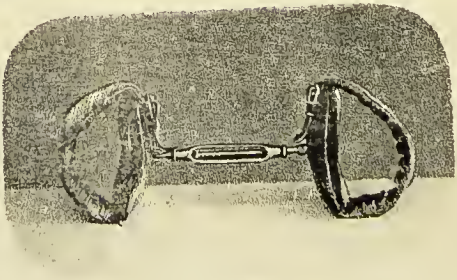


FIG 57.

(*b*) KNEE JOINT.

Fig. 55.—Apparatus for General Extension of Contracted Knee Joint.—Employed and recommended by Dr. Little. This instrument is provided with a ring catch and rack and pinion movement at knee, but its special feature is the addition of a crutch at the perineum, which is regulated by a screw movement attached to the thigh plate. The purpose of this crutch is to remove the principal weight of the body from the knee joint and transmit it to the ground. The ankle joint is supplemented by a very perfect detachable movement in the form of a "bevelled morticed joint," made firm by a sliding ring, thus enabling either a boot or metal shoe for night wear to be used.

Fig. 56.—Apparatus as above.—(*side view.*) Shewing details of mechanism at knee and ankle.

Fig. 57. — Extension Screw for Separation of Knees.—Introduced and recommended by Dr. Little. This screw is attached at either end to concave plates by ball and socket movement. The plates are securely fixed to the inner side of the knee, extension being gradually made by simply turning the centre portion of the screw.

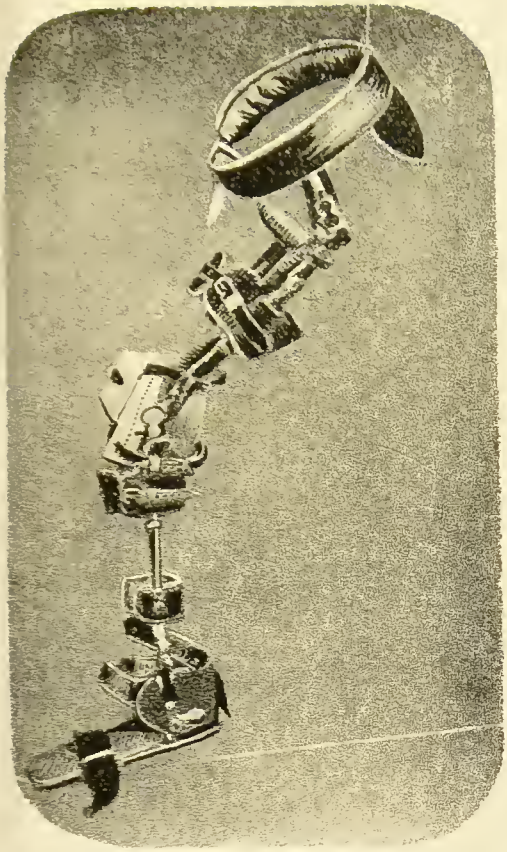
(*b*) KNEE JOINT.

Fig. 58.—Apparatus for General Extension of contracted Hip, Knee, and Ankle Joints.—This contains a ring catch and rack and pinion movement at hip joint, double action rack and pinion movement at knee, and double action rack and pinion movement at ankle. The crutch arrangement same as Fig. 55.

Fig. 59.—Apparatus as above (Front view). Showing details of crutch arrangement.

Fig. 60.—Box or Trough Splint for Genu Valgum.—The thigh and leg parts are connected at the knee joint by a lateral rack and pinion movement, enabling the splint in the first instance to be adapted to the deformity, and then straightened gradually as the case progresses.

Fig. 61.—Walking Steels to Pelvis with "Ring Catch" at Knee.—For use after cure of genu valgum. The knee joint is fitted with a "ring catch" movement and knee cap, enabling the instruments to be kept perfectly rigid when walking, and flexed when ascending, descending stairs, or sitting down.



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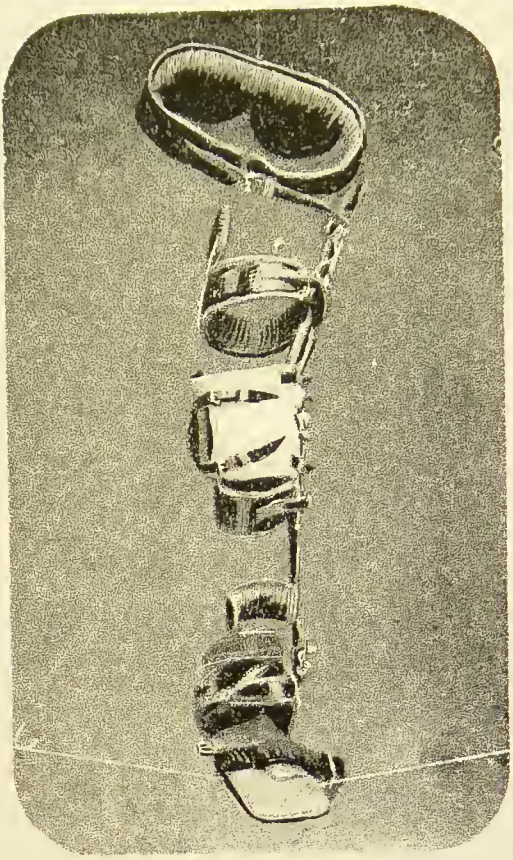

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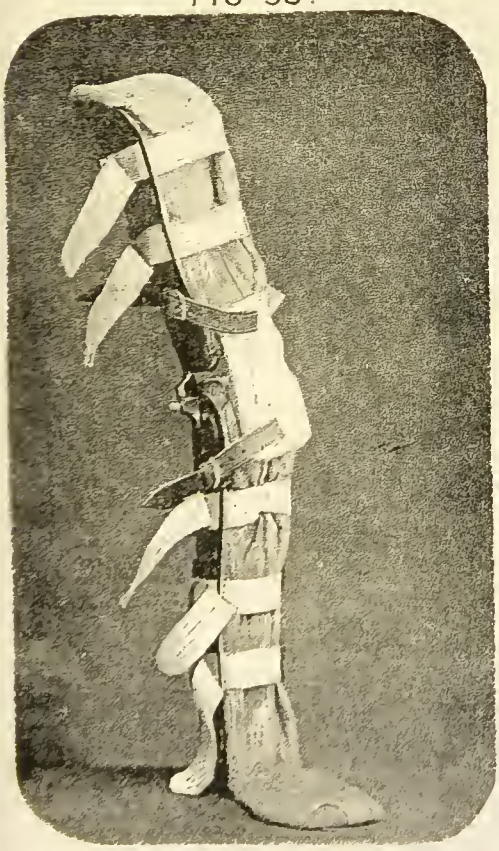

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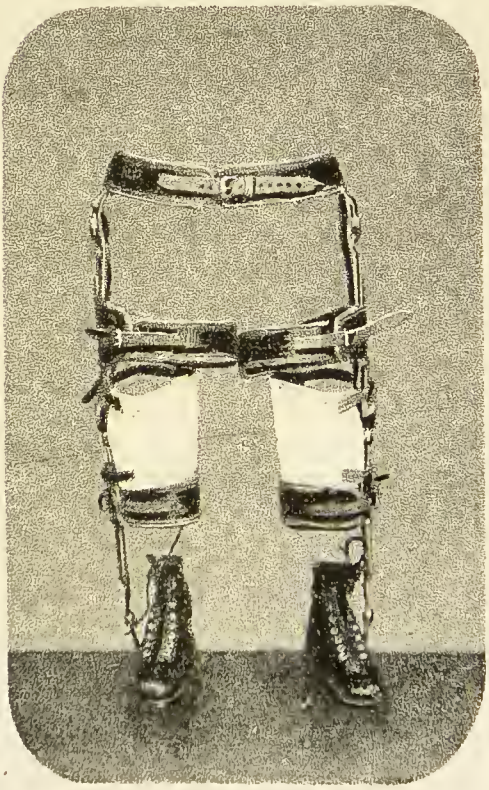

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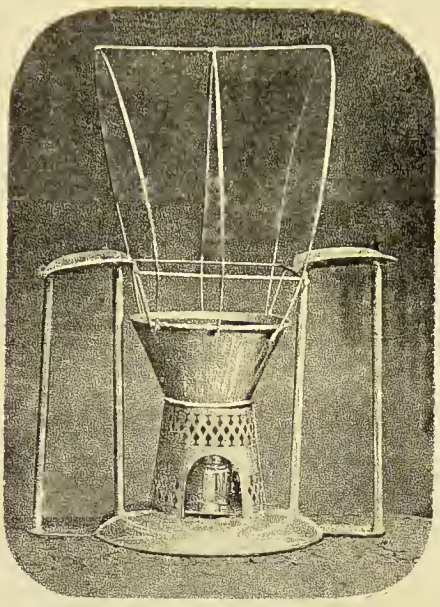

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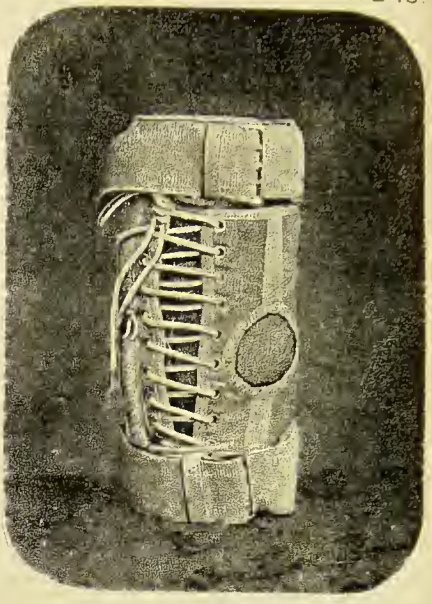

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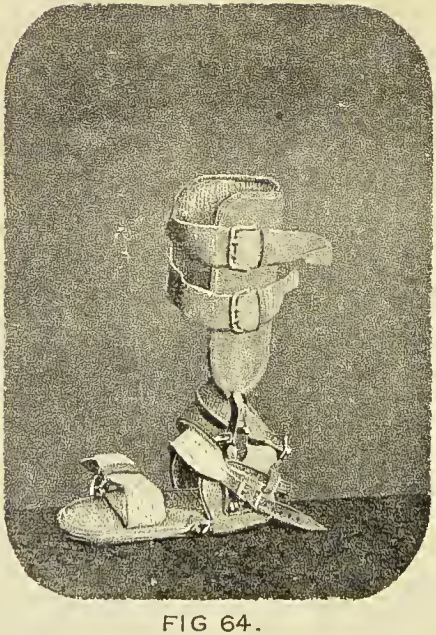

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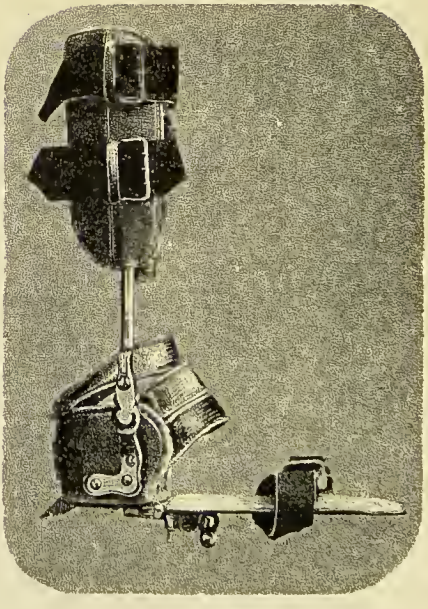


FIG 65.

(*b*) KNEE JOINT.

Fig. 62.—Knee Bath.—Employed and recommended by Mr. Adams. Used in cases of inflammation of knee or ankle joints.

Fig. 63.—Laced Knee Cap, with Convex Spring.—A moleskin knee cap, lacing in front with a convex spring, and free movement at knee. It is used for general support, after treatment by the trough splint, or in slight cases of dislocation or muscular weakness.

(*c*) ANKLE JOINT, CLUB FOOT.

Fig. 64.—Ordinary Scarpas Shoe.—With double-action rack and pinion movement at ankle, flexion and extension, inversion and eversion.

Fig. 65.—Scarpas Shoe for Varus, with Transverse Division in Sole Plate.—Employed and recommended by Mr. Adams. This shoe is divided at the sole plate in a line corresponding to the transverse tarsal joint, and contains three movements—No. 1, lateral; No. 2, uplifting; No. 3, rotation. The ordinary rack and pinion movements at ankle. The movements in the sole plate can be used separately or together according to the nature of the deformity.

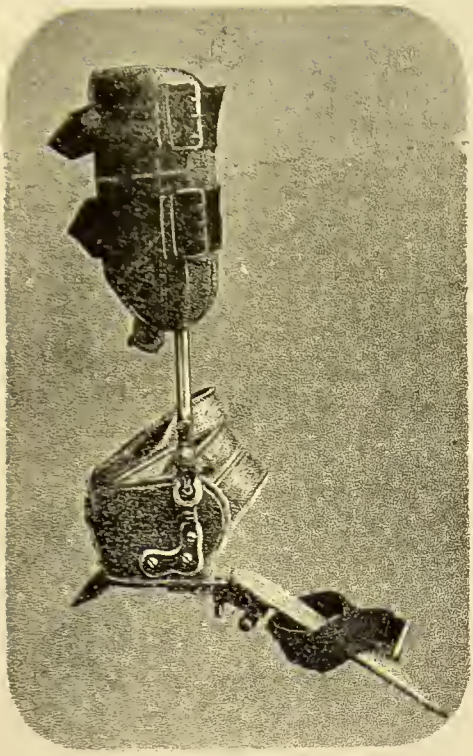
(*c*) ANKLE JOINT, CLUB FOOT.

Fig. 66.—Scarpas Shoe for Talipes Equinus with Severe Contraction of the Arch of the Foot.—Showing the action of the uplifting movement at the transverse division of the sole plate.

Fig. 67.—Scarpas Shoe for Slight Talipes Varus.—Showing the action of the lateral and uplifting movement at the transverse tarsal joint.

Fig. 68.—Scarpas Shoe for Severe Talipes Equino Varus.—Showing the action of the lateral, uplifting, and rotation movements at the transverse tarsal joint.

Fig. 69.—Scarpas Shoe for Talipes Equino Varus with Severe Contraction of the Arch of the Foot.—A fourth movement of an uplifting nature is added to the three actions in the sole plate to raise the plane of the front part of the sole plate above that of the heel, as shown in the illustration.



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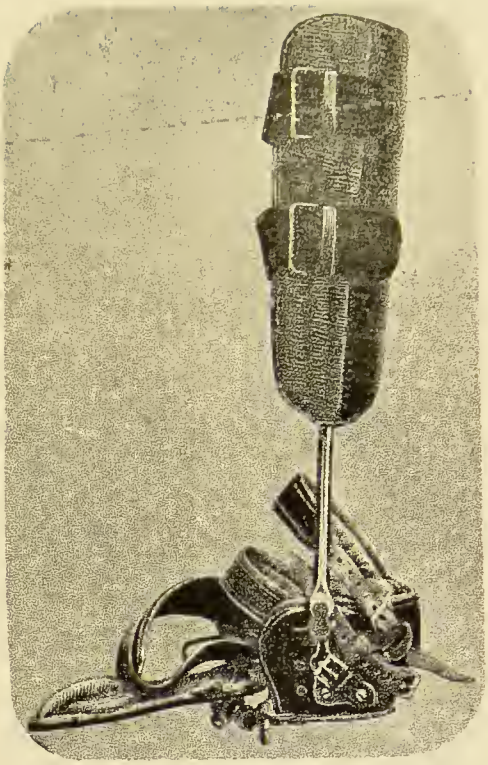

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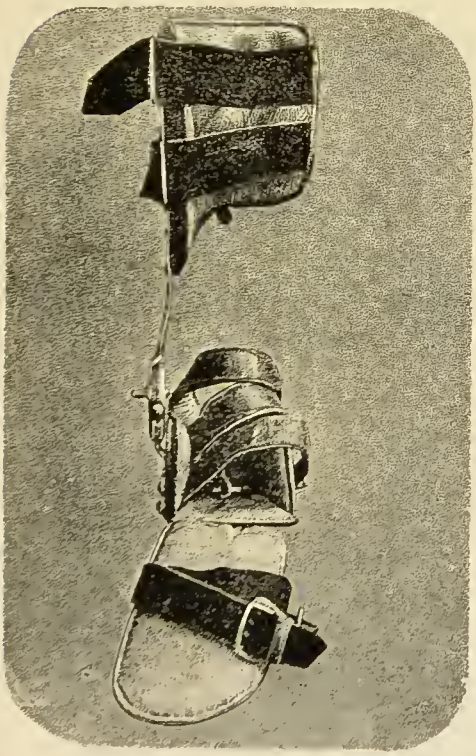

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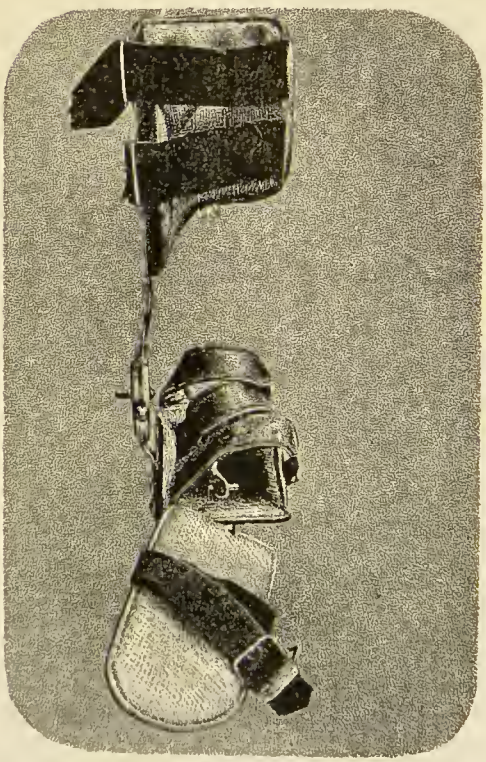

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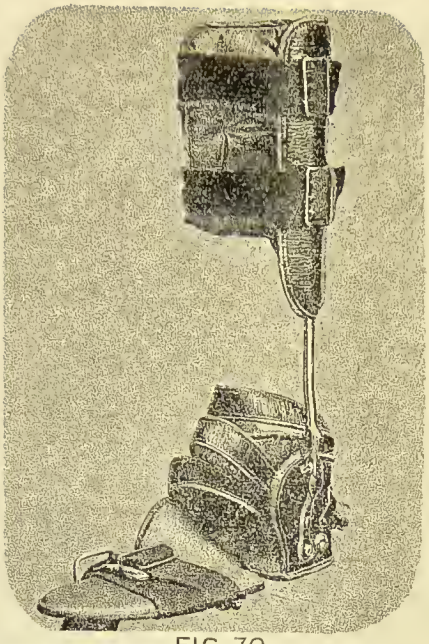

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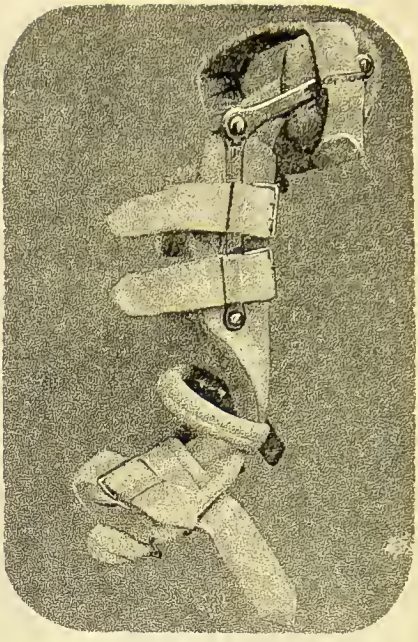

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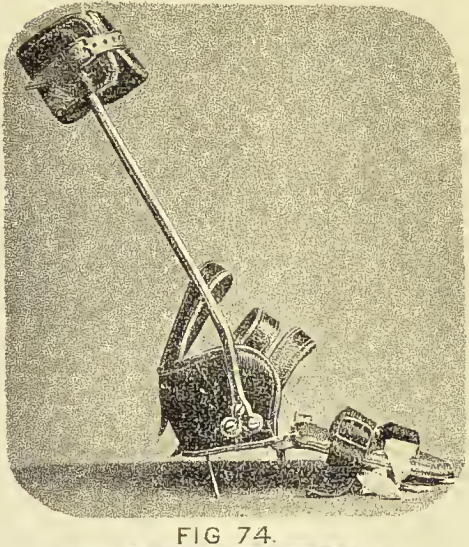

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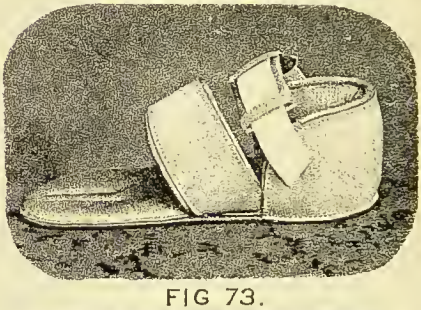

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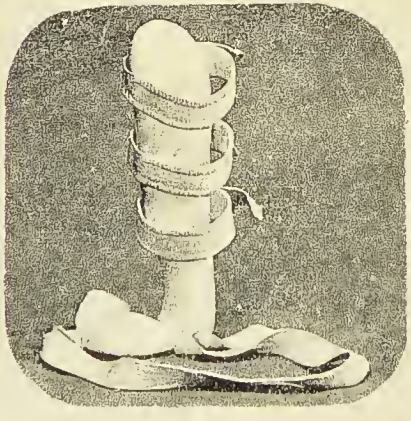

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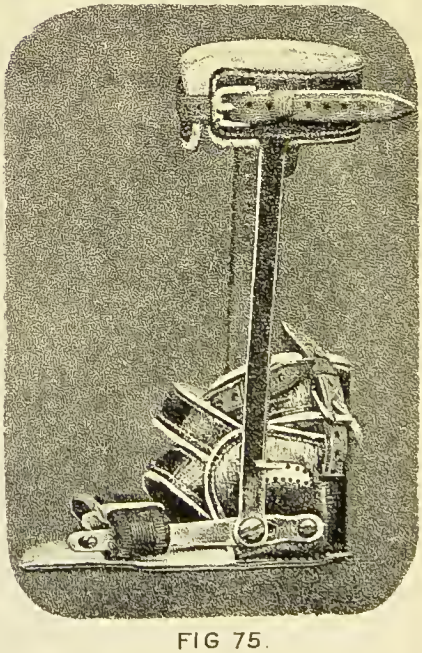


FIG 75.

(*c*) ANKLE JOINT, CLUB FOOT.

Fig. 70.—Scarpas Shoe for Talipes Valgus.—The same mechanism as that for varus, Fig. 65, Plate 15, with the addition of a valgus pad on the sole-plate for elevation of depressed arch.

Fig. 71.—Varus Splint for Infants.—Employed and recommended by Mr. Adams. This splint is carried above the knee with a free movement at the joint to counteract inversion of foot; a single uplifting rack and pinion movement is fixed at the heel to alter the angle of the sole-plate. It is employed in the second stage of treatment of congenital varus when the inversion has been overcome and the equinus alone remaining.

Fig. 72.—Splint for Congenital Valgus.—This consists of a metal piece fastened to the inside of the leg by a series of padded straps. A toe spring, having a sliding valgus pad, is attached to the lower extremity of the plate, and to which the foot is bandaged.

Fig. 73.—Sole Plate.—For use at night where there is a tendency to abnormal increase of arch. The sole plate is of metal, with a broad well padded strap over the instep.

Fig. 74.—Shoe for Calcaneus.—In this instrument no movement is supplied at the ankle joint, but an upright is fixed to the heel at an obtuse angle to give a fixed point for the action of the apparatus and favour contraction of the achilles tendon. An uplifting movement is attached to the sole plate to stretch the contracted fascia, and uplift the front part of the foot.

Fig. 75.—Varus Shoe.—Introduced and recommended by Dr. Little. This shoe comprises a long outside steel spring with convexity towards the leg, in addition to the usual shoe and calf plate. A toe spring is fixed at the heel of the shoe to evert the front part of the foot. The angle of the long outside leg spring is regulated by a thumb screw. In this kind of shoe mobility in an upward direction is permitted, the thumb screw regulating the amount of extension and preventing recontraction of the tendons.

(*c*). ANKLE JOINT, CLUB FOOT.

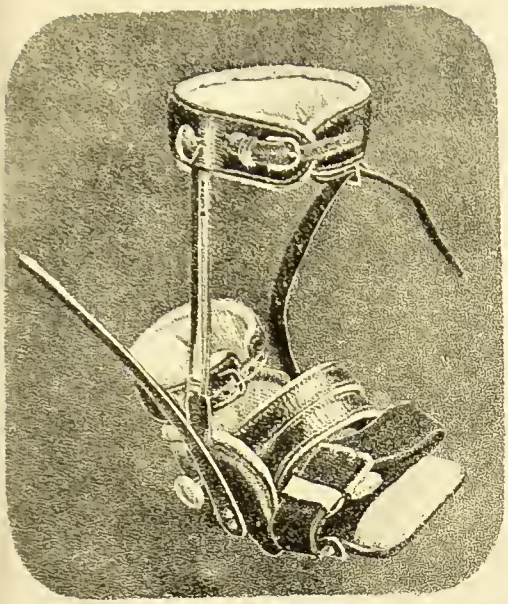
Fig. 76.—Double-Hinged Lever Shoe.—Employed and recommended by Dr. Little. This is used in severe cases of varus. The double-hinged lever admits of the immediate adaptation of the calf plate, the long spring being gradually drawn to the top of the lever by a piece of tape. In other respects the mechanism employed is the same as Fig. 75.

Fig. 77.—Long Spring Shoe with Rack Adjustment.—Employed and recommended by Dr. Little. The rack movement prevents any alteration in the angle at which the Surgeon has set the shoe. A slight upward movement is gained by the slot in the connecting lever.

Fig. 78.—Tin Splint.—Employed and recommended by Dr. Little. This figure represents a fixed right angle tin splint.

Fig. 79.—Tin Splint with Thumb Screw Movement.—Employed and recommended by Dr. Little. The same pattern splint as the previous figure, but with a thumb screw movement at the heel to regulate the angle as the case progresses.

Fig. 80.—Tin Splint with Knee Piece.—Employed and recommended by Dr. Little. A knee piece is added to the preceding splint with thumb screw movement, and is used in cases where slight contraction of the knee also exists. The connecting thigh piece is made of flexible metal sufficiently firm to retain its form and maintain the required amount of extension.



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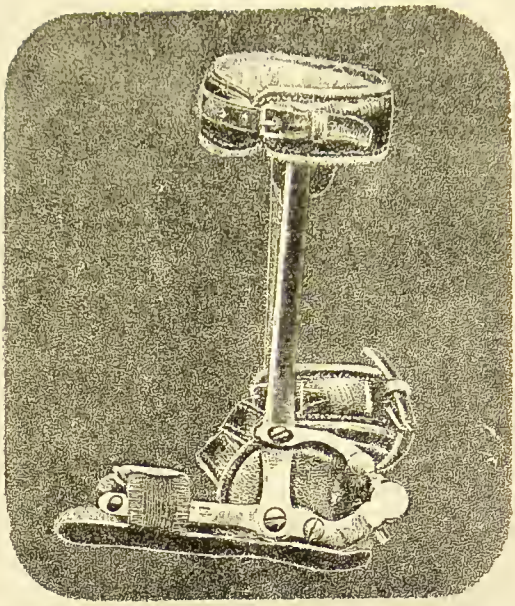

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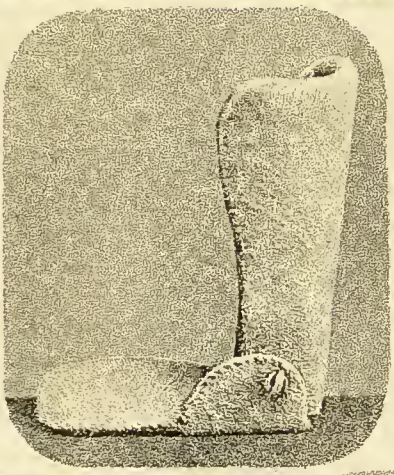

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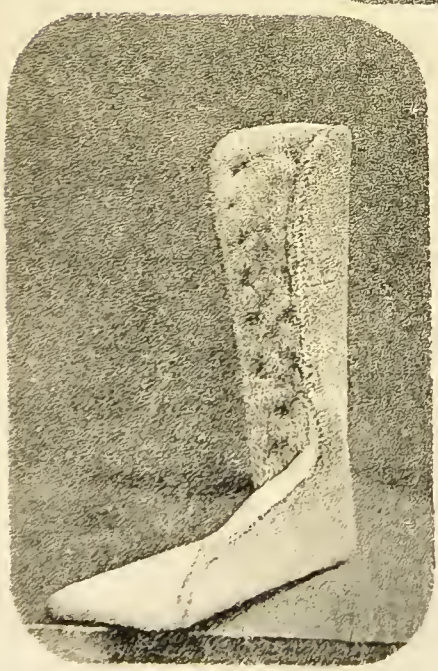

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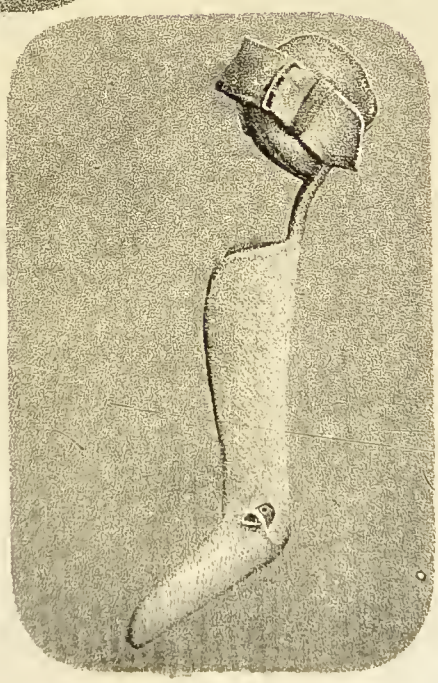

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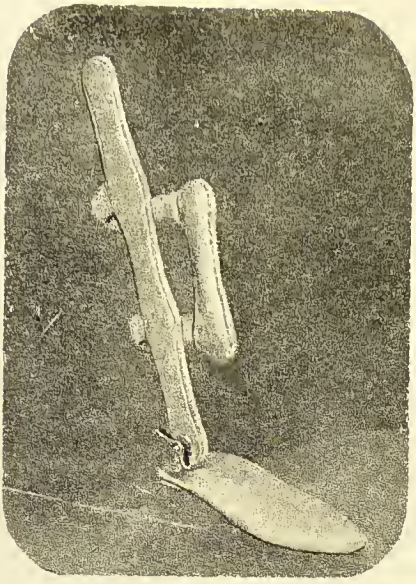

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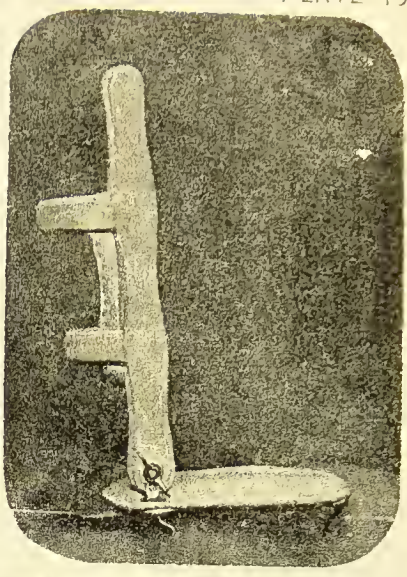

FIG 81.

FIG 85.

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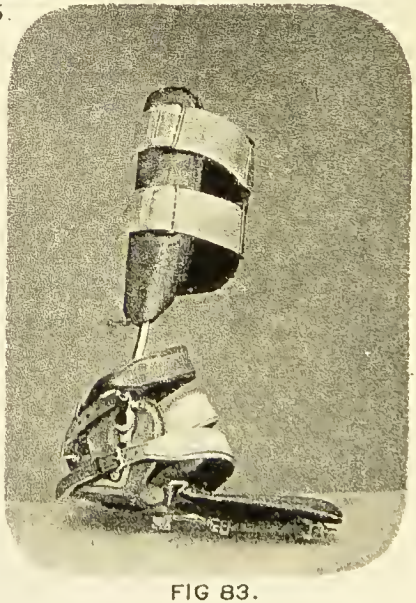


FIG 83.

(*c*) ANKLE JOINT, CLUB FOOT.

Fig. 81.—Adjustable Splint.—Employed and recommended by Dr. Little. A light splint, with double screw arrangement for altering the angle and controlling the inversion or eversion of the foot.

Fig. 82.—Adjustable Splint.—Showing adjustment of same.

Fig. 83.—Shoe for Severe Cases of Club Foot.—Employed and recommended by Mr. F. R. Fisher. The three actions are not used in the sole plate, but substituted by a ball and socket movement with a set screw. The principal feature of this shoe being the method by which the front part of the foot is extended from the tarsal joint.

WALKING APPARATUS FOR CLUB FOOT, PARALYSIS, Etc.

Fig. 84.—Double Upright Walking Instrument.—Consisting of light steels to calf, detachable by simple keyhole catch disconnection at the ankle joints, adaptable either for varus or valgus. If for varus, the instrument must have a varus ⊤ strap attached to the boot to support the ancle. If for valgus, the ⊤ strap is reversed, and a valgus pad inserted in the boot to elevate the depressed arch. Oblique heels to the boots are always necessary for the latter deformity.

Fig. 85.—Steel Spring Varus Walking Boot for Infants.—Introduced and recommended by Dr. Little. This simple spring is used after cure by the varus splint; it is attached to a boot, and worn with the convexity of the spring to the outside of the leg.

Fig. 86.—Concealed Spring.—Introduced and recommended by Dr. Little. A light convex spring inserted in boot for slight cases of valgus, varus, or weak ankles. It has a free joint, corresponding to the ankle. For varus it is placed on the inner side of the shoe with the concavity of the spring towards the inner ankle, whilst in valgus it is placed in the reverse position, and, when necessary, a valgus pad is added.

Fig. 87.—Concealed Spring.—Showing spring inserted in boot.

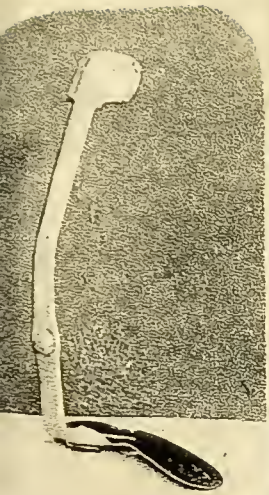
Fig 88.—No. I. Walking Instrument.—Introdueed and recommended by Dr. Little. For use after cure of either varus or valgus, and respeetively used on the outer and inner side of the leg. The power of the spring is regulated by the controlling strap on the opposite side of the spring, whieh should be buekled sufficiently tight to bring the foot in its normal position in walking.

Fig. 89.—Walking Steel for Slight Paralysis of Anterior Muscles of Leg.—This apparatus is most useful in eases where paralysis of the anterior muscles of the leg exists. Its construction and prineiple will readily be understood on reference to the illustration, where the spring is shewn in full action. When in use, on placing the foot on the ground the weight of the body overcomes the spring, and the foot is perfeetly flat along the sole and heel, but immediately the foot is raised the spring acts automatically, and raises the toe, so that in walking a natural gait is obtained, and the foot prevented from eatehing or tripping against uneven objeets.

Fig. 90.—Walking Instrument with Combined Toe Elevating and Long Spring.—A eombination of Figs. 88 & 89. This apparatus is useful in eases of slight varus with paralysis of anterior muscles of leg.

Fig. 91.—Walking Instrument with Combined Toe Depressing and Long Spring.—Suitable for eases of Caleaneus.

Fig. 92.—Walking Instrument with Adjustable Elevating Movement.—This apparatus is a eombination of Figs. 88 and 89, Plate 20, and Fig. 93, Plate 21. The principal feature is the addition of a regulating movement, by which the uplifting force of the toe elevating spring ean be regulated to give a slight or powerful action, according to the requirements of the ease.



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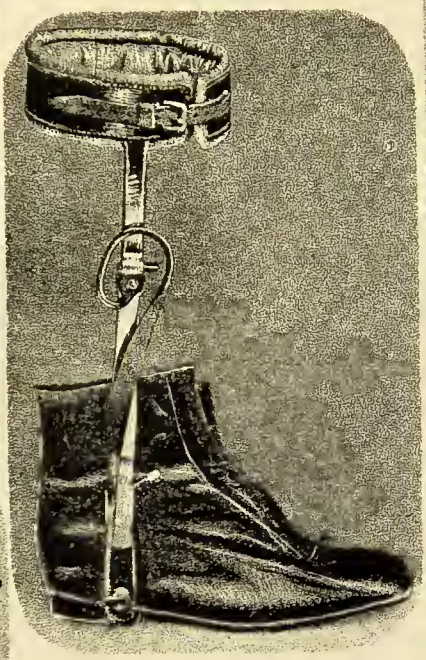

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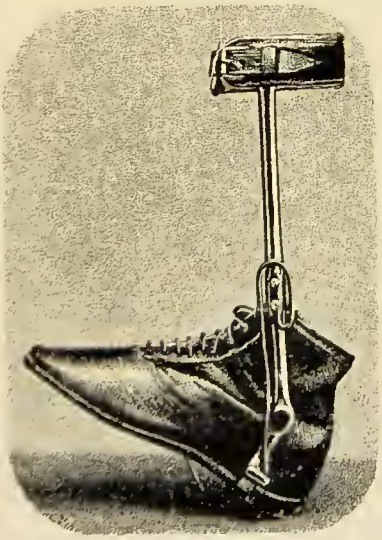

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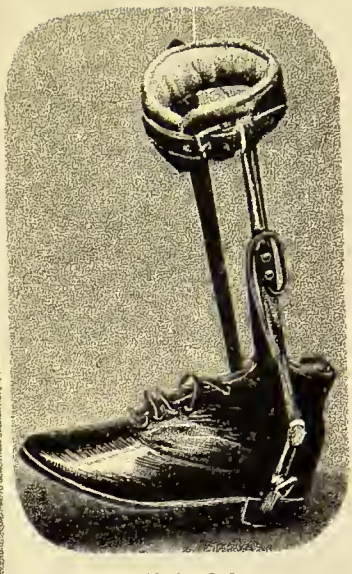

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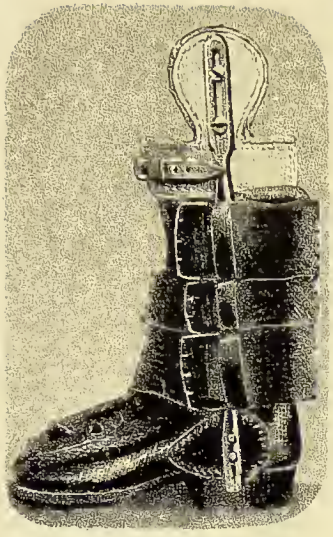

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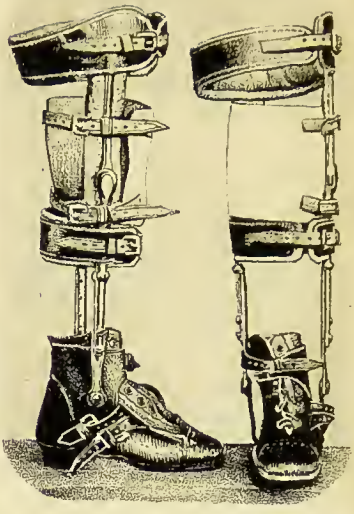

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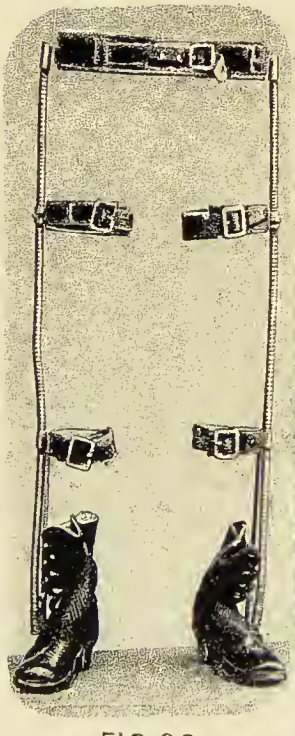

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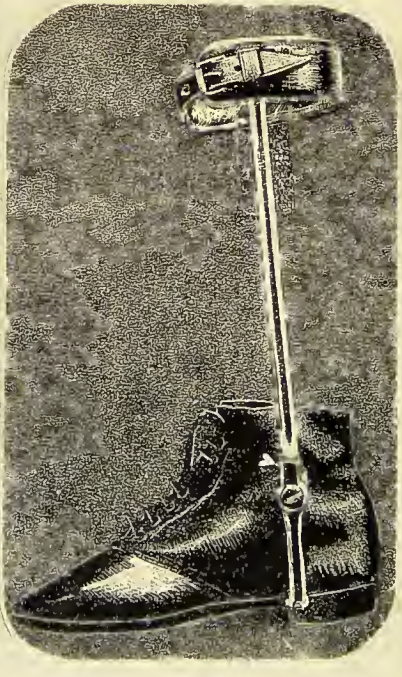

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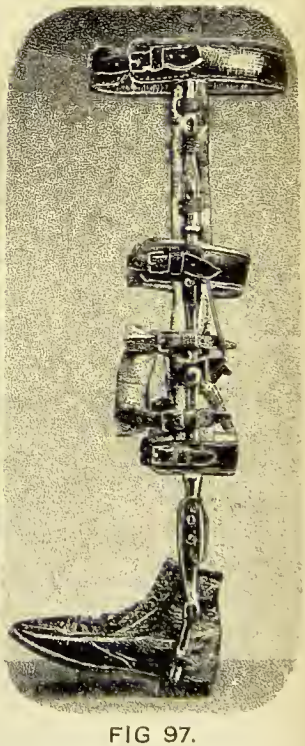


FIG 97.

Fig. 93.—FIRM UPRIGHT WALKING INSTRUMENT WITH REGULATING STOP JOINT. Employed and recommended by Dr. Little. Used either for valgus or varus after treatment. A screw passes obliquely through the top double joint for the purpose of regulating the angle of the instrument, thus preventing any tendency to recontraction and allowing free upward movement.

Fig. 94.—WALKING STEELS FOR CURVED TIBIA.—This apparatus is attached to a boot, counter pressure is taken from below the ankle, and on the knee joint: the necessary pressure on the curved tibia is made by a series of straps passing over a back wire, and giving the requisite oblique pressure.

Fig. 95.—WALKING INSTRUMENT TO THIGH.—For use in cases of talipes varus after treatment by scarpas shoes. The thigh part with knee cap is added to varus instruments where much inversion of the foot takes place; and a noticeable feature is the transverse internal toe strap, which assists in everting the foot from the transverse tarsal joint. The illustration shows both the front and side views.

Fig. 96.—WALKING INSTRUMENT WITH FLUTE KEY CATCH JOINT AT KNEE.—Useful in cases of paralysis of the anterior muscles of the thigh; the joint at knee can be flexed by pressing the lever above it. The apparatus is used perfectly fixed during walking, but by means of the catch arrangement can be released whilst ascending, descending stairs, or sitting down.

Fig. 97.—WALKING INSTRUMENT FOR PARALYSIS OF ANTERIOR MUSCLES OF THIGH AND LEG.—This apparatus possesses the advantage of mobility combined with great supporting power to the affected limb. It contains a gun lock spring at knee and toe elevating spring at ankle, which supply the place of the paralysed muscles, and give great assistance to locomotion.

Fig. 98.—DR. DOYLE'S SPIRAL SPRING ROTATOR.—An apparatus to pelvis with spiral springs extending from the ground to the pelvis for the treatment and correction of abnormally inverted or everted feet. It is useful in cases of club foot after treatment, hip disease and fracture of the neck of the femur, where it is necessary to maintain a certain amount of rotation, &c. In applying it for cases of club foot, the pelvic belt is first to be fastened in place, and the boot to which the spiral spring is attached is to be rotated inwards once, twice, or as many times as the case may require. The foot is then to be placed in the shoe and secured there, and the straps at the thigh and calf are to be buckled. It will be seen at once that the spring's tendency to resume its former position will rotate the foot outwards.

Fig. 99.—Walking Instrument to Pelvis.—For children after cure of congenital varus. A double joint is used at the hip, allowing of the ordinary flexion and extension or lateral movement, at the same time perfectly controlling the tendency to inversion of the feet. By the addition of the double joint at the hip the apparatus is less liable to fracture, and in no way diminishes the powers of locomotion.

Fig. 100.—Firm Upright Walking Instrument.—A light instrument, with free joint at ankle extended to calf. Suitable for slight cases of either varus or valgus.

CONTRACTED OR HAMMER TOES AND BUNIONS.

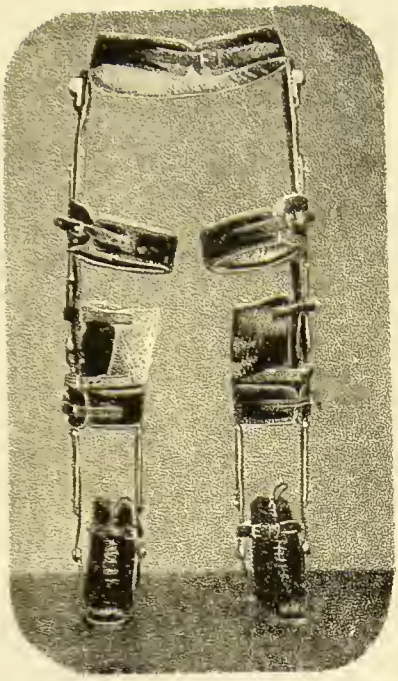
Fig. 101.—Shoe for Hammer Toes.—A light metal sole plate, with slots cut at the extremity for all or either of the toes, which are extended by means of a small strap passing round the toe, and counter elevation by a pad fixed to the extremity of the sole-plate.

Fig. 102.—Half Metal Sole Plate for Day Use.—Designed for use in a large boot or slipper. The toes are retained in position by elastic straps.

Fig. 103.—T. Spring for Day Use. A light spring worn under the sole of the foot, adaptable for one toe only.

Fig. 104.—Bunion Spring. Intended for night wear, with an oval opening over the bunion to avoid direct pressure on the affected point. The toe is gradually everted by a small strap passing round it, fixed to the end of the spring.

Fig. 105.—Shoe with Outside Spring. A combination of the bunion spring and metal sole plate.



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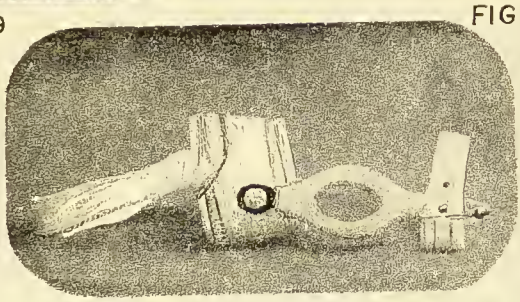

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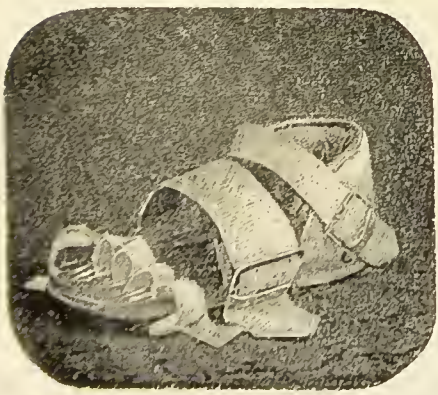

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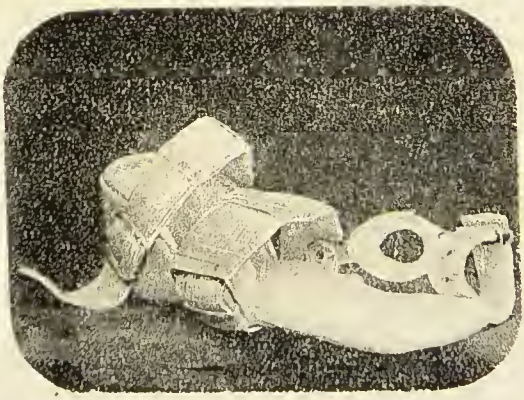

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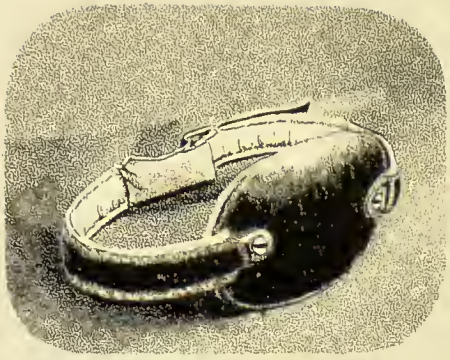

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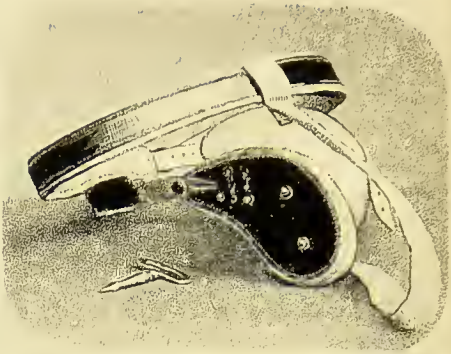

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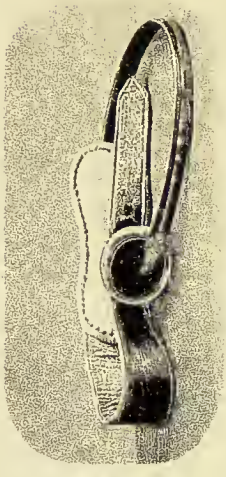

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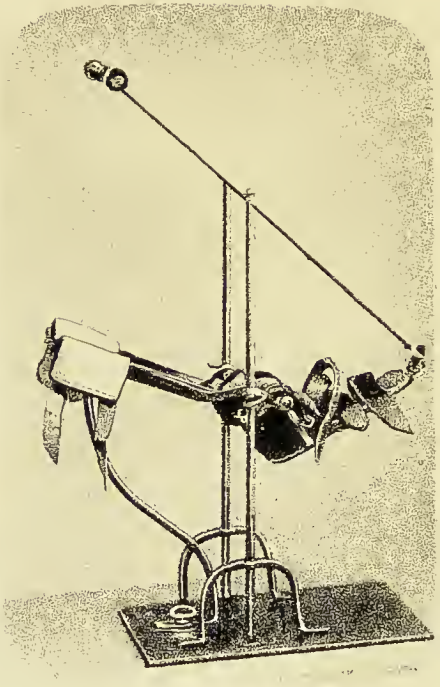
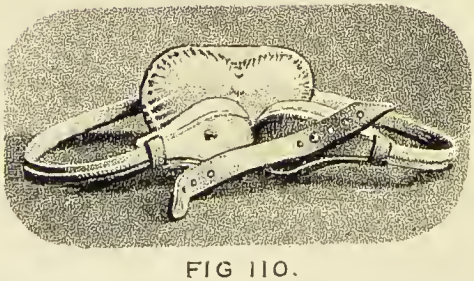


FIG 112.

FIG 109.



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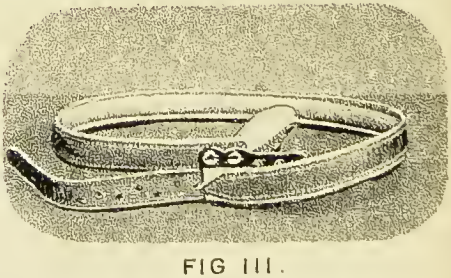


FIG 111.

Fig. 106.—Umbilical Steel Springs and Pad, for Umbilical and Ventral Hernia. — An oval plate covering the region of the umbilicus with a conical pad in the centre, its object being to prevent the hernia from projecting. It is kept in place by light lateral steel springs, which are buckled at the back; it is also useful in cases of abdominal weakness, for which the conical pad is removed, and the flat plate only used.

Fig. 107.—Truss with Rotation Movement in Pad.—In severe cases of hernia this truss is very useful, as the plane of the pressure can easily be rendered more or less oblique.

Fig. 108.—American Truss.—The spring supports the hernia by passing in front of the pubes to the opposite side on which it exists, thereby giving a longer leverage and greater resistance.

Fig. 109.—Bathing Truss.—The ordinary inguinal truss covered with India rubber.

Fig. 110.—Double Truss with Adjustable Plate at Back.

Fig. 111.—Dr. Dick's Truss.—Consists of an auxiliary spring attached to the end of the long spring, giving a direct uplifting power. This truss is exceptionally easy and comfortable in wear. As the retaining force depends on the auxiliary spring, the circumferential one need only be sufficiently powerful to keep the pad *in situ*.

EXERCISING APPARATUS.

Fig. 112.—Foot Exercising Apparatus.—This is a most useful apparatus for acquiring motion in stiffened ankle joint, or stretching the tendo achilles without division. By the addition of a second movement in the sole plate corresponding to the transverse tarsal joint, any minor contraction of the plantar fascia can be overcome. The joints are made with a ring catch, so that each centre of motion can be worked separately. The foot is strapped in the shoe, and the patient exercises and stretches the foot by means of the lever. A much greater power and a more regular exercise is obtained by the use of this machine than by ordinary hand manipulation. This apparatus is shown in action, Fig. 113, Plate 24.

Fig. 113.—Foot Exercising Apparatus.—This illustration shews the apparatus in use. For full description, see Fig. 112, Plate. 23.

Fig. 114.—Trapèze Bar.—This simple apparatus is largely used for exercise in lateral curvature of the spine and muscular weakness. The webbings are made to shorten or lengthen according to the height of the person and room. It should be so arranged that the patient stands on tip toe when grasping the bar firmly in order that the toes may clear the ground when swinging. The exercise consists in swinging backwards and forwards, thus combining suspension with muscular movement, and favouring straight growth and development.

Fig. 115.—Trapèze Bar, Double.—Employed and recommended by Mr. Adams. This is the same construction as the single trapèze, but has the addition of a lower bar. It is used in severe cases of lateral curvature; the hand of the side with the concavity being placed on the higher bar during exercise, so as to give greater extension to the contracted muscles. The movement is precisely analogous to that for the single bar.

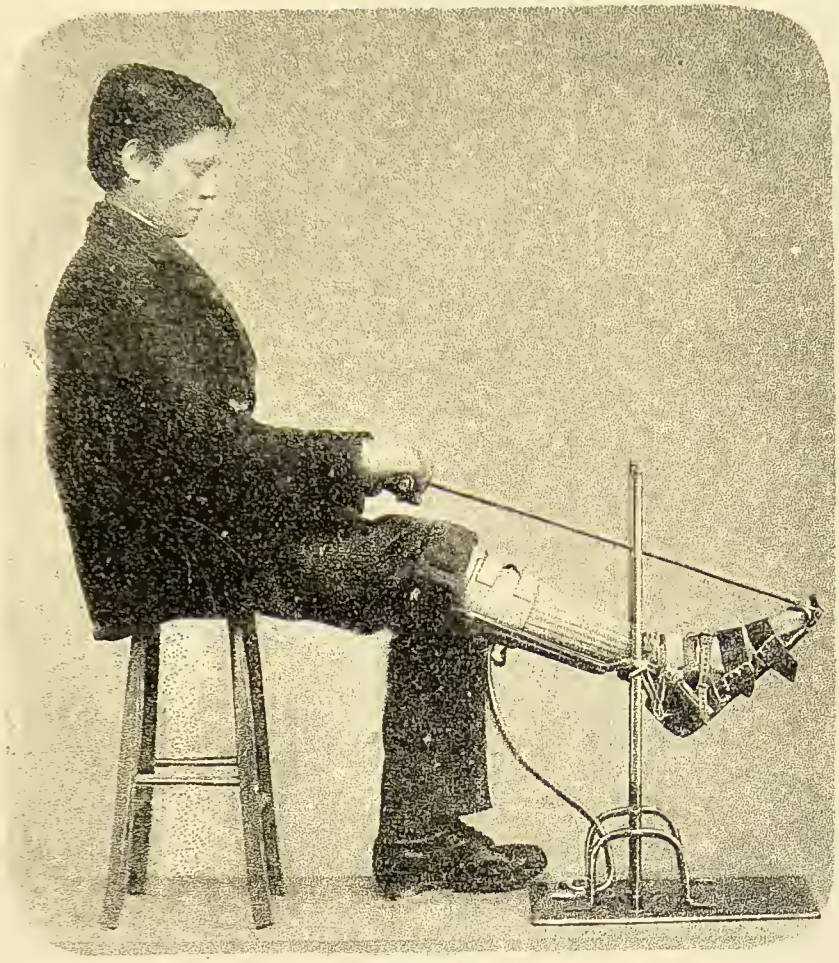


FIG 113.

FIG 114.

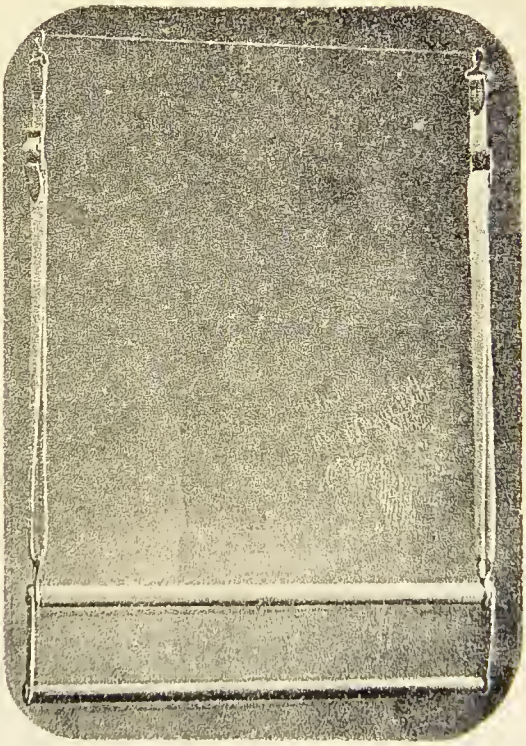


FIG 115.

FIG 116.

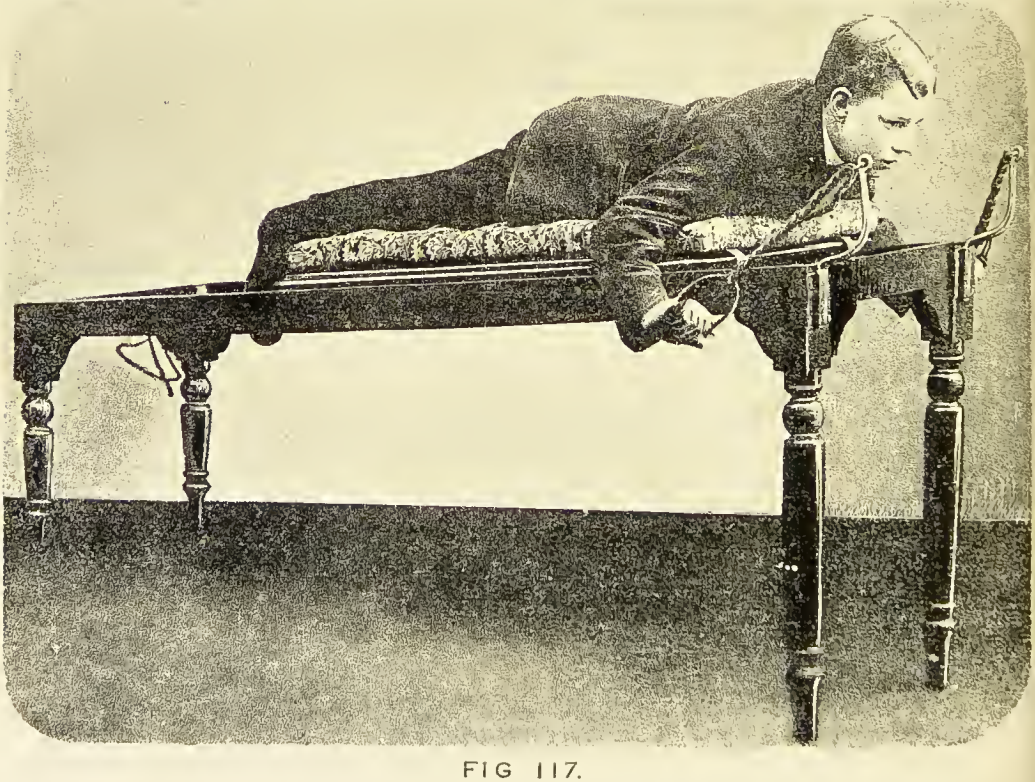
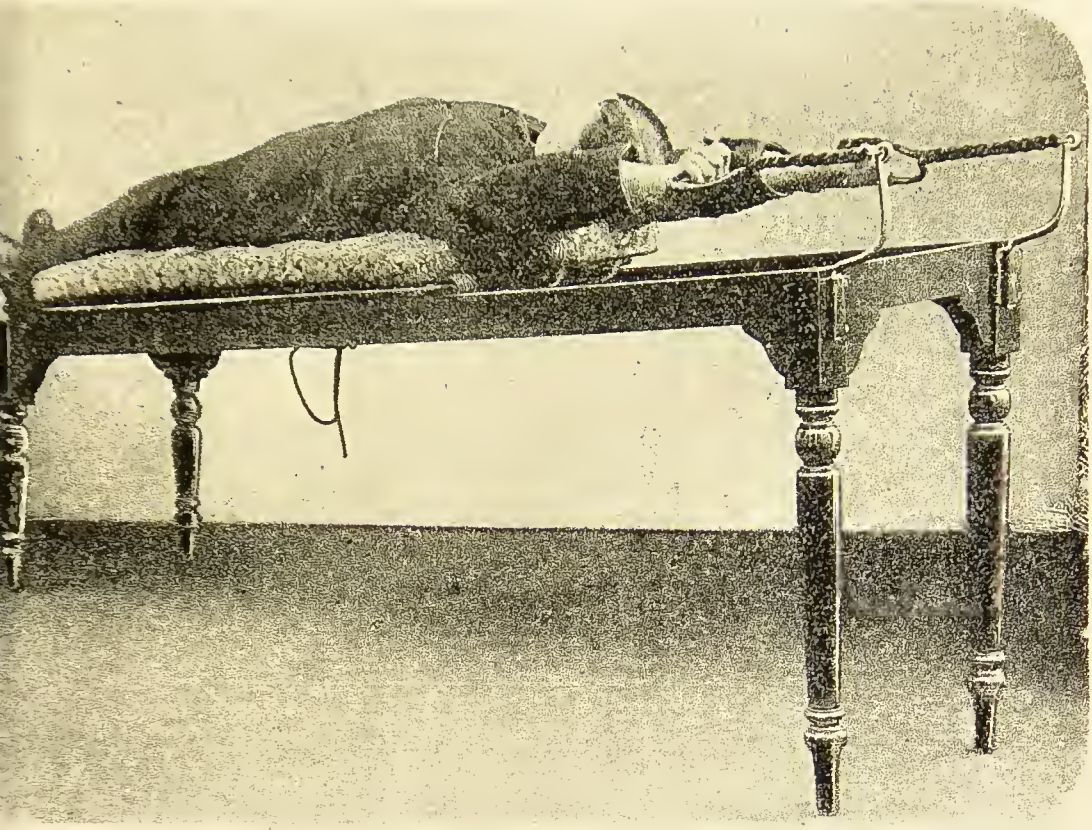


FIG 117.

Figs. 116 & 117.—Exercising Plane.—Introduced and recommended by Mr. Adams. This apparatus, which is much used in cases of lateral curvature of the spine, especially during the period of active growth, is a modification of Shaw's and Amesbury's, and was designed by Mr. Ernst at the suggestion of Mr. Adams. It consists of an inclined plane, six feet long, with a rise of one inch in the foot, a sliding board (half the length) fitted with rollers is moveable up the inclined plane in grooves at the sides, detachable handles are fitted to the upper end of the plane, which are held by the patient during the exercise. An india rubber accumulator fixed to the top of the couch on the inside and connected to the board by a cord passing over a pulley at the lower end of the plane, is a means by which the exercising power is regulated. There are two kinds of exercises, one taken on the chest to exercise the spinal muscles, the other on the back to exercise and develope the chest muscles. The exercise is taken by the patient lying perfectly flat on his chest, on the moveable board, and grasping the handles at the top of the couch with each hand. He then pulls himself gently up the plane and remains at the top for a few seconds, then relaxes his hold and descends; this position exercises the spinal muscles. The other exercise for the chest development is taken in the same manner only the patient lies on his back; a head rest is attached to the sliding board to support the head in this position. In many severe cases the handles at the top of the plane are made to lengthen or shorten so that a greater power of extension may be given to one side than the other.

Figs. 118 & 119.—For description of these illustrations, see preceding page.



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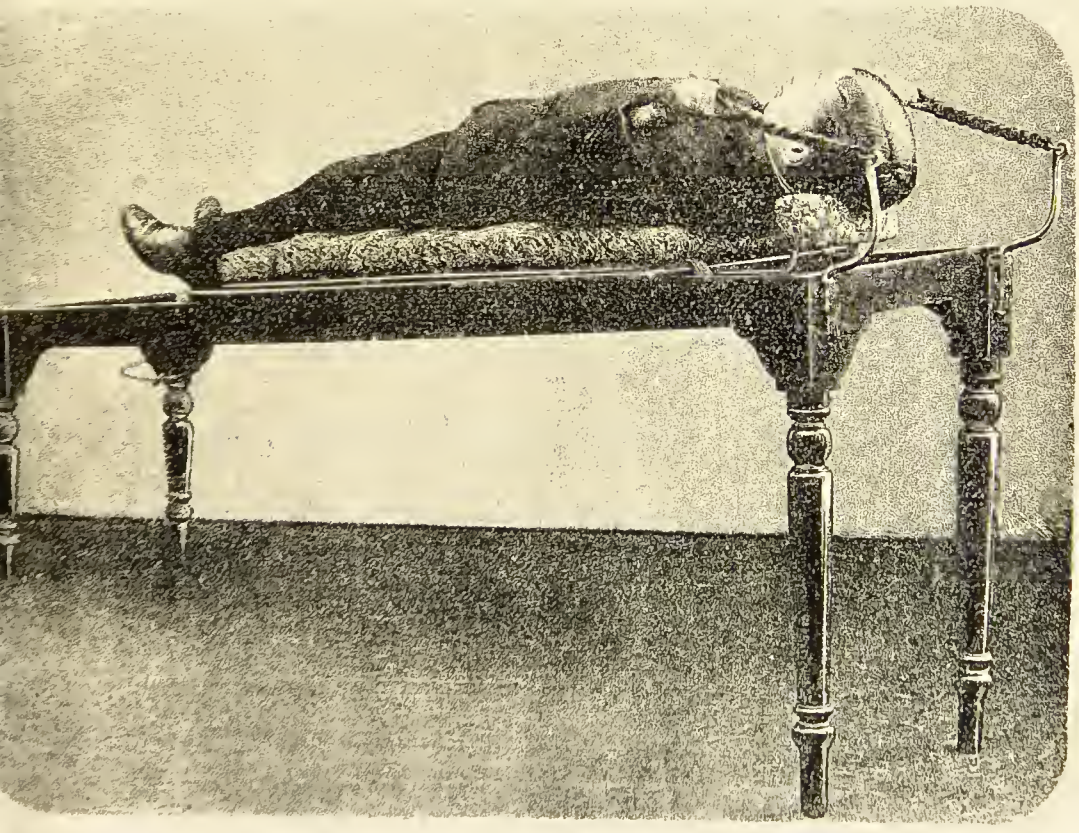

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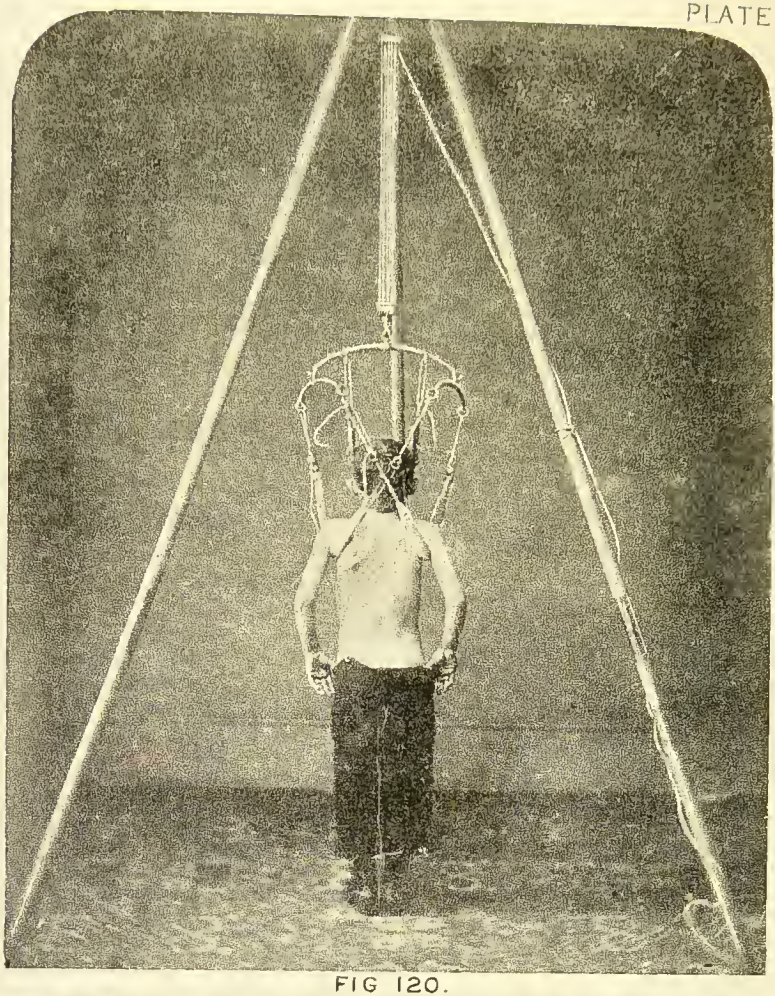

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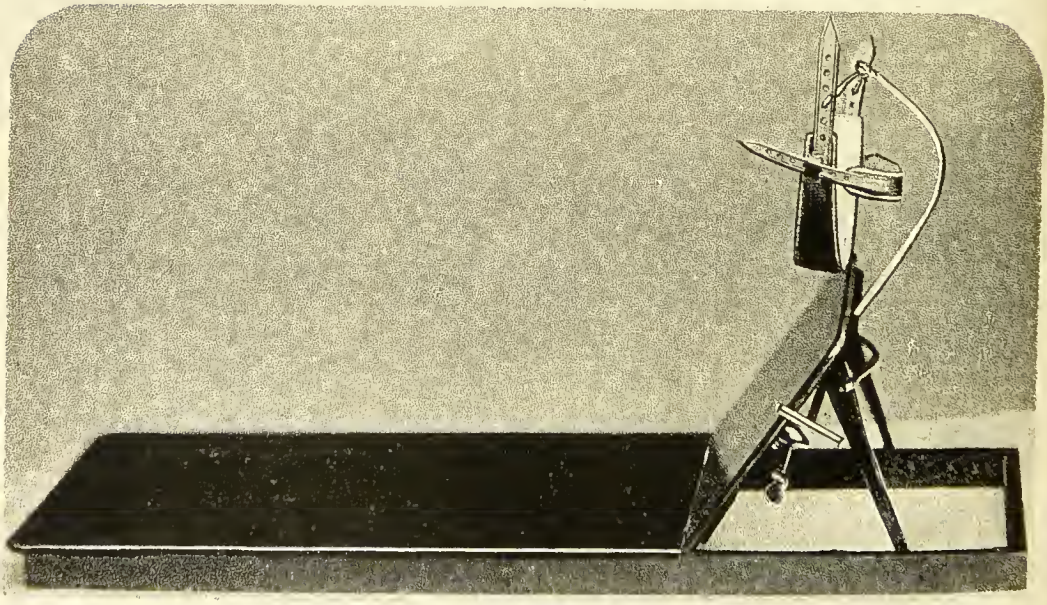


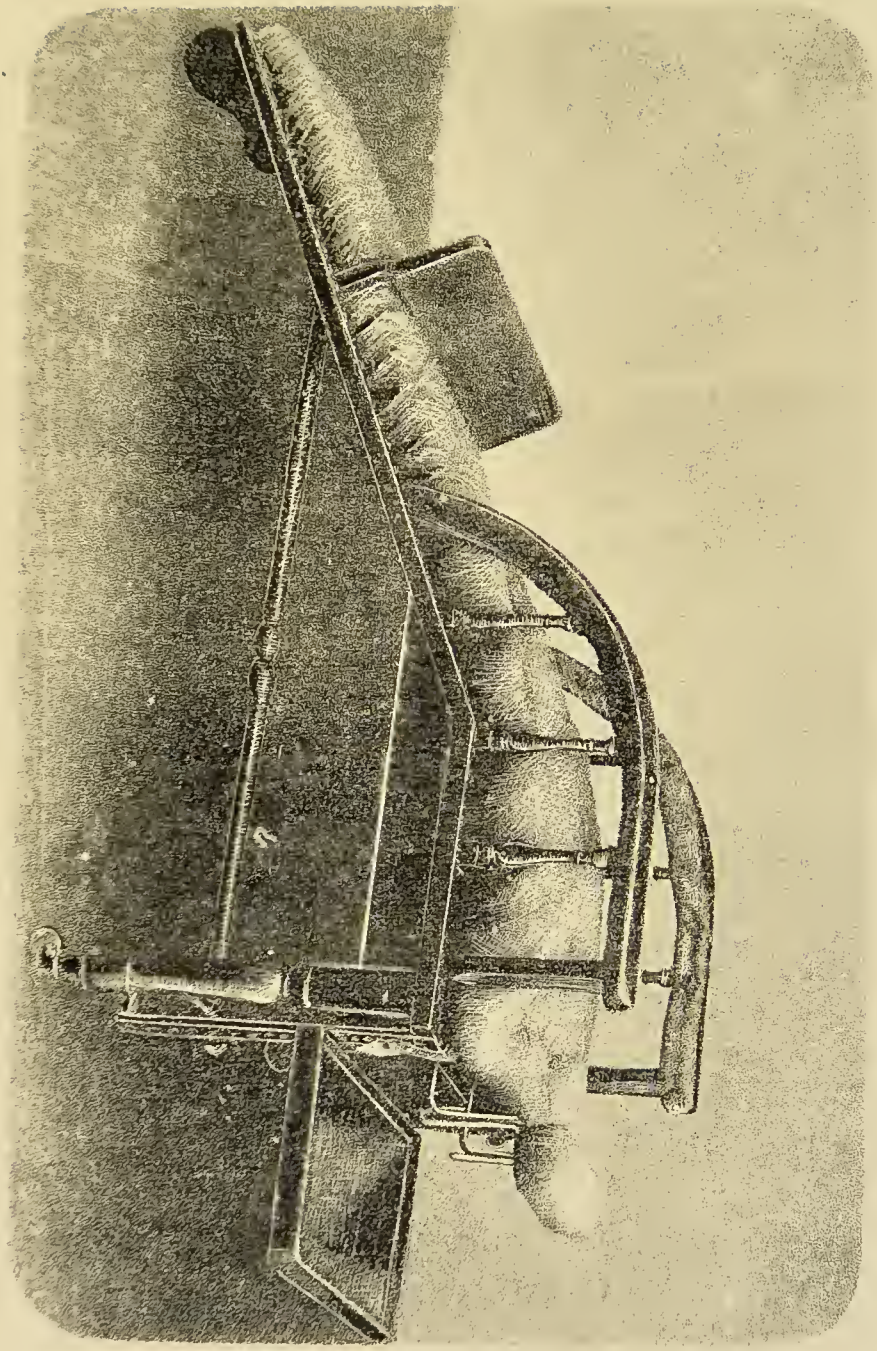
FIG 121.

Fig. 120.—Sayres' Improved Suspension Apparatus.—The improvements in this apparatus are threefold.—Firstly, a check pulley is used, by means of which a patient can be fixed and remain suspended at any height during the application of a Poroplastic or Plaster of Paris Jacket, without the help of an assistant to hold the cord of the pulley. Secondly, the straps for suspension, both head and arm, are an entirely different and superior pattern (of Mr. Ernst's design), to the ordinary kind; the head strap takes the weight from the chin and the occiput, and the arm-straps are hung from small auxiliary cross bars, straight in front but crossed at the back, thus the right arm-strap in front becomes the left at back and *vice versâ*. In self suspension, this arrangement of crossing the straps at back affords a firm bearing under the axillæ, and prevents any tendency to slip up the arms, as sometimes occurs when they are taken directly from the cross bar on either side. Thirdly, the straps are connected to the auxiliary cross bars by Mr. Durham's checks, enabling the operator to adjust the tension and distribution of weight in a moment. This very simple and ingenious arrangement is figured in Mr. Ernst's pamphlet on Poroplastic Jackets.

Fig. 121.—Mr. Ernst's Apparatus for Keeping a Patient Extended in the Horizontal or Reclining Position.—(Used during the treatment of Pott's disease in the cervical and upper dorsal vertebræ). By this means a patient can either sit up, lie down, or recline at any angle without altering the degree of suspension. The apparatus consists of a jointed plane, with an arrangement for altering the angle of reclination, a stem with cross piece for attachment of head strap is fitted with a rack and pinion movement, worked by a key at the side so that the amount of tension can be regulated very accurately and then maintained by a catch spring.

Fig. 122.—Mr. Ernst's Improved Prone Couch.—This couch is adapted to secure complete recumbency during the day with the least amount of restraint and monotony. It is fitted with a head rest, foot board, and reading table, which can be adjusted by means of a simple catch arrangement. By the addition of the reading table, the patient is enabled either to read, write, paint, draw, or follow any sedentary amusement. The guard rails on either side prevent any possibility of accident by slipping off the couch.

PLATE 28.



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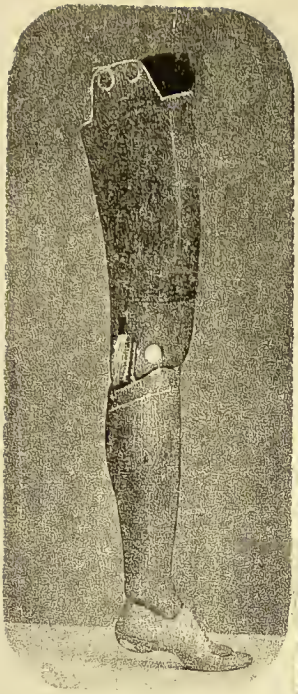

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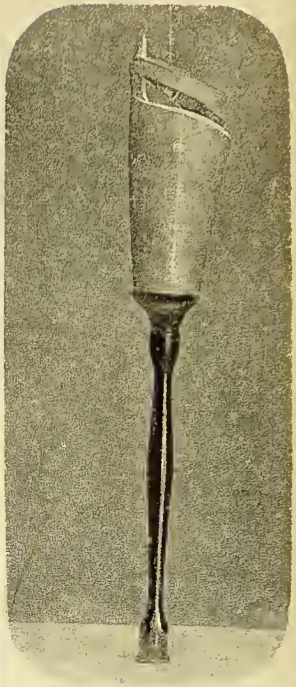

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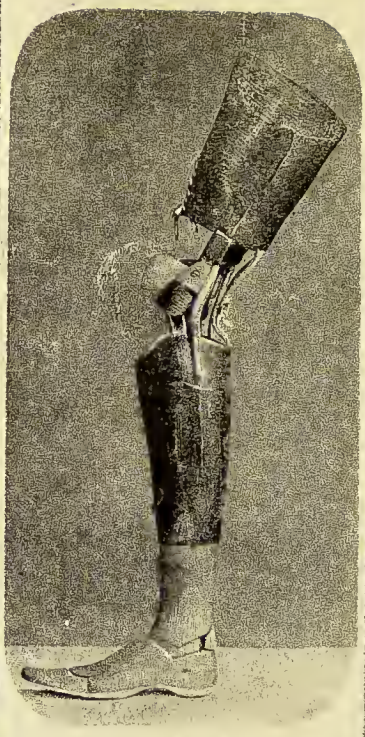

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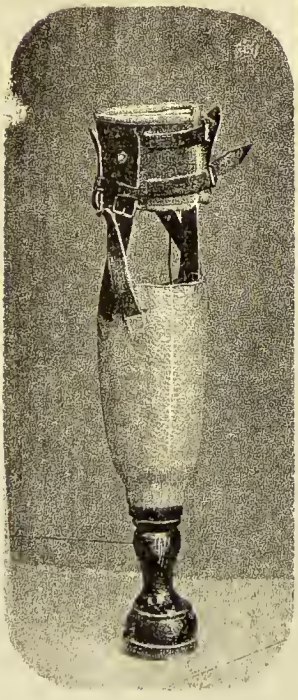

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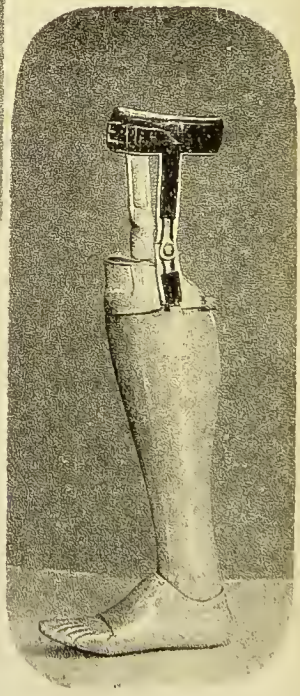


FIG 126.

ARTIFICIAL LEGS FOR AMPUTATION ABOVE KNEE.

Fig. 123.—This figure represents an artificial leg with all the articulations. It is fitted with the tendon arrangement, and both the material and workmanship are of the highest quality. The foot part is sometimes replaced by a pin according to the requirements of the patient.

Fig. 124.—Ordinary Pin Leg.—This is a cheap form of leg for amputation above knee. It can also be fitted with a knee-joint and stop, enabling the patient to bend the knee when sitting down.

ARTIFICIAL LEGS FOR AMPUTATION BELOW KNEE.

Fig. 125.—Artificial Leg with all the Articulations and Tendon Arrangement.—The workmanship and material are of the highest quality. The leg is fitted with steel joint at knee, and thigh supports. It is securely fixed to the limb by an extra pressure strap above knee, entirely dispensing with the use of braces.

Fig. 126.—Artificial Leg for long Fleshy Stump without Thigh Support.—A well-padded ring encircles leg above knee, and firmly secures the limb in position.

Fig. 127.—Ordinary Artificial Leg without any Articulation.—This is a cheap and serviceable limb for hospital patients.

ARTIFICIAL LEGS FOR AMPUTATION BELOW KNEE—*continued.*

Fig. 128.—Artificial Leg with Knee Joints and Thigh Support, terminating with Pin instead of Foot.—The construction of the upper parts of the leg is in every way the same as in Fig. 125.

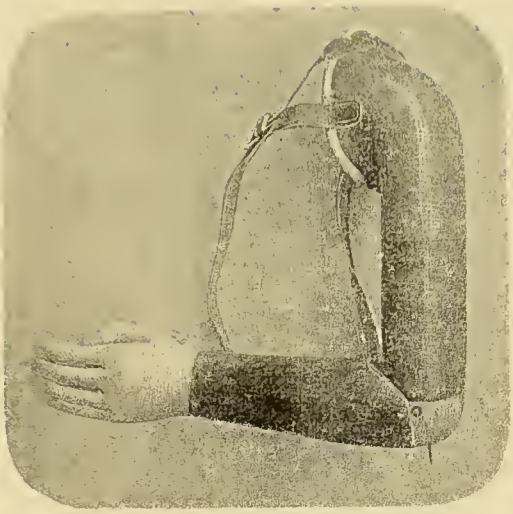
Fig. 129.—Ordinary Pin Kneeling Leg.—This is frequently fitted with a cradle, and is very serviceable in cases where complete rest to the ankle-joint is required without preventing locomotion.

ARTIFICIAL ARMS AND HANDS.

Fig. 130.—Artificial Arm and Hand for Amputation above Elbow or at Shoulder Joint.—Fitted with regulating stop joint at elbow, to alter the angle of flexion or extension; rotation movement at wrist, and articulations of all finger joints.

Fig. 131.—Artificial Arm and Hand for Amputation below Elbow Joint.—Fitted with upper arm-piece and steel elbow joint. The mechanism of the hand same as preceding figure.

Fig. 132.—Artificial Hand for Amputation at Wrist Joint, with all Articulations.—A cheap form of apparatus called an "arm socket," fitted with a hook, knife, or fork is also made, and is very serviceable in wrist or below-elbow amputations, and very suitable for poor patients.



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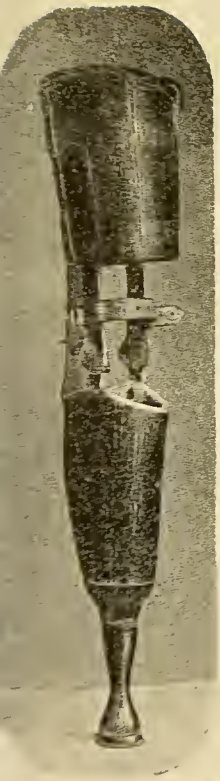

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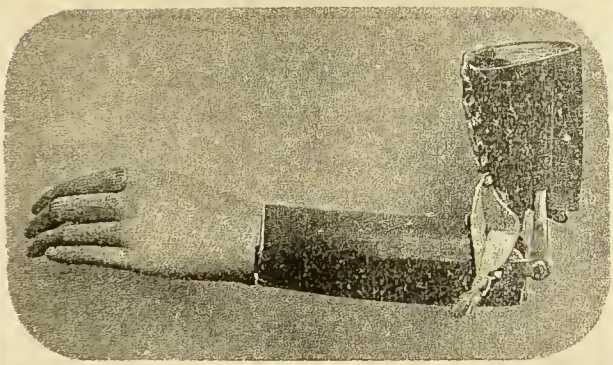

FIG 131.

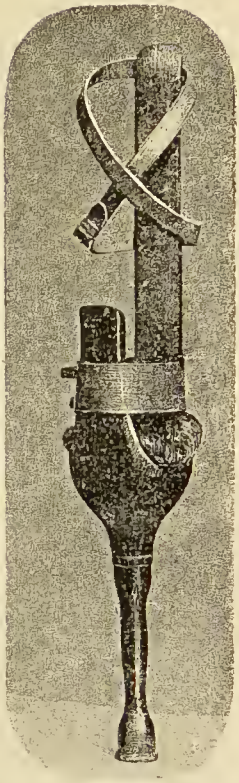

FIG 129.

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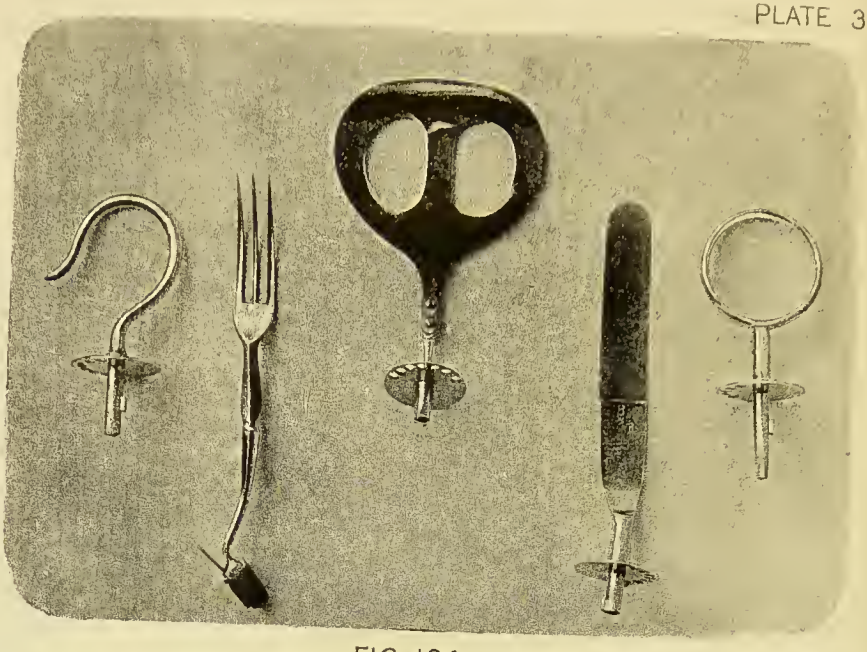

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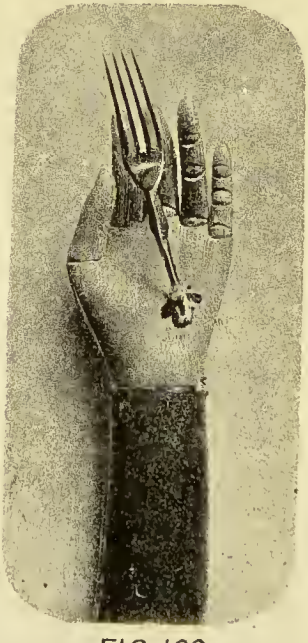

FIG 133

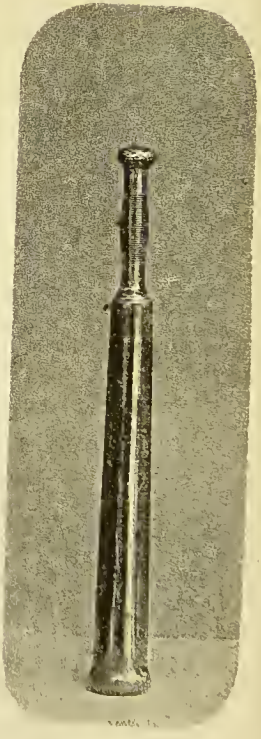

FIG 136.

ARTIFICIAL HANDS—*continued.*

Fig. 133.—Artificial Hand.—Shewing method of fixing fork or other instrument.

Fig. 134.—A few of the Instruments most generally in use with Artificial Hands.—Special instruments to perform various kinds of work can be devised to suit the requirements of patients.

EXERCISING CLUBS.

Fig. 135.—Ordinary Indian Club.

Fig. 136.—Box Club.—The interior of this club is hollow, admitting of a series of leaden weights, enabling the same club to be made heavier or lighter in weight according to the requirements of the user and exercise.

With reference to the more ordinary appliances, such as Abdominal Belts, Elastic Stockings, Suspenders, Crutches, &c., although supplied by me, I have not enumerated, as their different forms are already so well known.

PART II.

THE

PORTABLE GYMNASIUM

AND

DESCRIPTION OF THE VARIOUS EXERCISES

CONNECTED WITH IT.

INTRODUCTION.

THE beneficial effects arising from the employment of Gymnastic Exercises, as a curative agent in cases of spinal deformity, or other bodily weakness and contraction, are so generally known and appreciated that an advocacy of the system is here quite needless. I shall, therefore, abstain from entering on the merits of the various systems comprehended in the category of "mechanical assistance," and confine myself to a definition of the class especially adapted for those suffering from vertebral deflection, or other local disarrangement, as well as to the more general movements which tend to develope and restore the symmetry of the human form. It may seem that the simplicity of this remedy, consisting as it does in pure muscular action, is devoid of all interest and reduced to a mere display of physical power; and yet, if the attention be once awakened and fixed on the subject, there is an increasing charm involved in its principle; it is, as it were, an innate gift of nature, the capacity for helping and restoring herself, the fact being that on the exercise of the weak and suffering member health and beauty are dependant. We all know that *use* has developed the "thews and sinews" of the labourer, and that it is use which enables many physical exertions to be accomplished which otherwise would seem impracticable. If, then, the great value of use be admitted, what effects may we not calculate upon, when, under judicious treatment, use is brought to bear upon the debility of an inert or weak muscular frame?

The full amount can only be understood by those whose experience is derived from close acquaintance with the effects of this curative agent, and it is because I am fully impressed with the importance of gymnastics in orthopædic practice that I now

venture to give a series of directions for the guidance of those, who, themselves, pursue or introduce into the educational system of their families a course of physical training.

To carry out my convictions, I have arranged an efficient portable gymnastic apparatus, experience having clearly demonstrated the necessity of keeping up regular daily exercise. It is constructed in the form of a pedestal, so as to enable anyone to carry about with them the necessary means for continuing the exercises especially required, as well as those taught in public or private institutions, and I have great satisfaction in finding my efforts most fully approved by many eminent medical men, and reciprocated by a large circle of patients who constantly practise the system I have suggested.

In the following pages the exercises are illustrated so as to demonstrate to the patient their right use.

F. GUSTAV ERNST.

80, Charlotte Street, W.

1883.

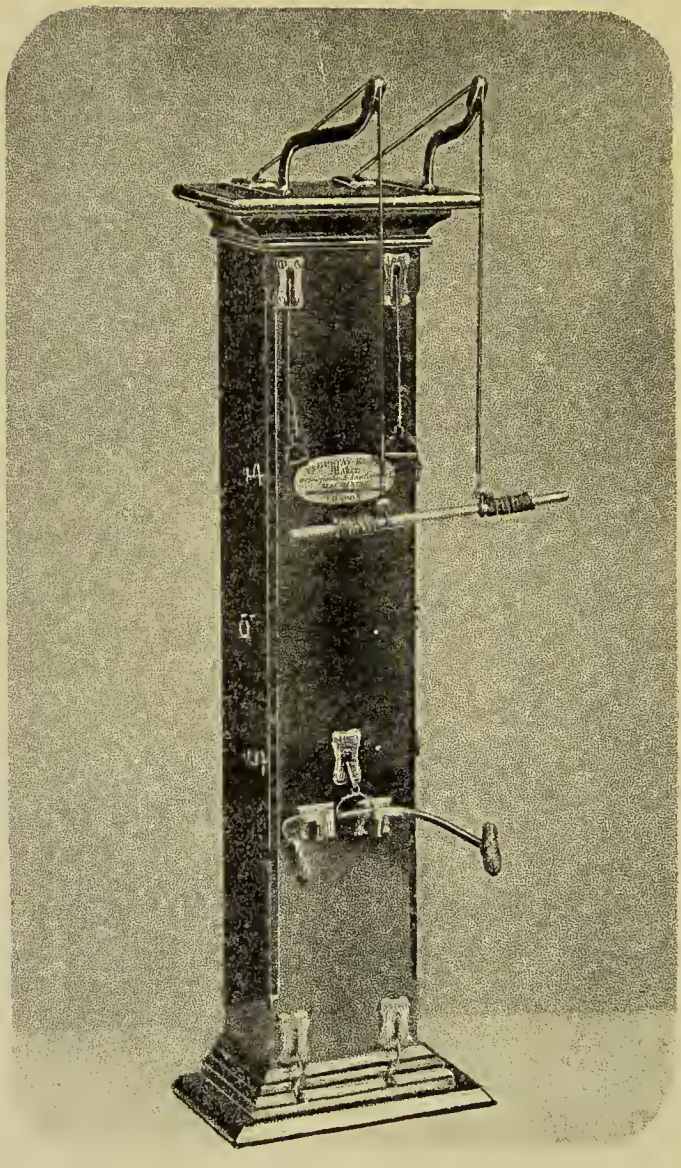

FIG Ia.

GENERAL DESCRIPTION

OF THE

PORTABLE GYMNASIUM.

THE Portable Gymnasium, Fig. 1*a*, Plate 1*a*, is constructed in the form of an oblong pedestal, and varies in height from 6 to 9 feet 6 inches, and is usually 7 by 8, or 9 by 14 inches deep and wide, the pedestal resting on a firm base proportionately larger than itself. The whole is secured to the wall of any sufficiently lofty room by strong iron brackets and screws, in such a manner that it may be removed with the greatest ease, and without injury to the wall. Doors are arranged on either side, in order to give access to the weight carrier, and admit of the weights (which are of two sizes, representing respectively a pound and a half-pound) being increased or diminished, according to the strength of the patient, after the regulation of which the doors must be securely closed, in order to avoid any disarrangement of the mechanism, and prevent the chance of accident.

Various pulleys are fixed in the interior as well as on the exterior of the pedestal, under and over which, in mutual conjunction, run strong hempen cords, to the end of which, *i. e.* the internal, swivels are fastened for the attachment of the weight carrier, and to the other ends, which are external, are also fastened swivels, intended for either the handles or staff, according to the exercise in use. Two handles and a short staff

furnished with eyeloops are supplied, for the purpose of carrying out the different directions necessary for the execution of the various Gymnastic movements.

On the face of the pedestal, at a convenient height from the ground, is fixed a firm handle, so as to afford the learner as much steadiness as possible whilst performing certain lateral exercises. On either side of the central pulleys stand vertical rollers, the object of which is to ease, in an immense degree, the traction in the lateral exercises, the revolutions of the rollers, as the cords pass over them, materially diminishing the labour, and obviating the friction on the cords.

As it would be difficult, especially for children, to reach the upper swivels, when the top series of exercises is required, recourse is had to long webbing loops, which have swivels sewn on them, and which, being attached to the highest external swivels, afford a simple and ready means of drawing them down, so that either the staff or handles may be attached. At the bottom of the pedestal, inside, a thickly padded board, resting on strong spiral springs, is placed, which prevents the noise and jerk of the descending carrier.

One great advantage in the form of the Portable Gymnasium, Plate 1*a*, is its size and shape, for not being larger than an old-fashioned eight day clock case, it occupies very little space, and can be stationed in any room; whilst the general advantages appertaining to its use are so apparent, that a few of the most prominent ones need only be enumerated. In the first place, the toil and expense of travelling to a further or less distant public gymnastic establishment is dispensed with; the patient, having the means always at hand, can commence the exercises with a frame whose strength has not been previously taxed by a tiring walk or ride, and rendered in a degree unfit for the performance of the prescribed exertion. Every needful movement, too, can be obtained from the pedestal, and at the same time the duration of the lessons is not limited to any set time, which must be the case where there is a constant succession of pupils, as, for example, far more benefit is to be derived from a *quarter of an hour's practice*,

repeated four times a day, than from *one hour's continuous use once in the same period.* It also serves for adults or children—stronger or weaker individuals—the division of the resisting power into numerous separate weights rendering it adaptable to the capacity of either; nor is any accident likely to arise to children in using it, although it is desirable to have the surveillance of a competent person, so as to prevent them from tampering with the interior adjustment.

In an economical point of view, it will, where there are several members in a family, repay itself in less than six months, if the expenses incurred by using a public gymnasium are considered; although it may be needed for restoration in a case of spinal deflection, or loss of muscular power, yet it will afford to other members of the family, in town or country, such salutary amusement as may rank with useful occupation when unfavourable weather or other circumstances preclude out-door exercise.

The symmetrical and even ornamental structure of the pedestal renders it an unobjectionable addition in any room, and its transmission and packing can be so easily and cheaply effected that to families often changing their residence no cessation need occur in its use.

DIRECTIONS FOR EXERCISING.

Severe cases of spinal deflection are seldom met where recourse has not been had to one or other form of mechanical support, which is constantly worn. Any such apparatus must be removed before commencing the exercise, otherwise muscular movement will be impeded, full bodily power restrained, the exercises imperfectly performed, and development limited. Immediately after the exercising period has expired the appliance should be resumed.

The exercises, especially at the commencement, must not assume the character of a toil or labour, begin with a definite

number of movements, from six to fifteen, and such an amount of weight on the carrier as may be easily managed. For example, should six movements with two pounds weight occasion a sensation of strain on any one set of the muscles, then the weight must be reduced, but not to so low an amount that the traction can be effected without some little exertion.

Having established the status as to *weight*, go on with the exercises for about three weeks, at the end of which time double their number, and after the lapse of a similar period increase the weight. With this augmentation, diminish the number of movements to the starting limit and progress as with the lighter weight, from time to time adding a pound or half-a-pound, so that the ultimatum may be gradually and imperceptibly attained.

It is a general rule in cases where the bodily frame is *not* the subject of lateral spinal deformity, that either arm must alternately perform the exercises a like number of times, otherwise, the flexor and extensor muscles of one side of the body will gain in volume over the other, and originate a deflection; whereas, by *regular* and *alternate* use, a perfect and general development will go on, and equal muscular antagonism be maintained.

The case is, however, very different in decided lateral curvature, for then a series of muscles on either side of the spine are effected, equally in degree, but differently in locality, and the deflection would only be increased by following the above axiom; an alteration in the system of treatment must be adopted, and one set of exercises practised with the right hand, another with the left, so as to exert and develope the deteriorated muscles on either side. Under these circumstances, the medical attendant's opinion is *absolutely necessary*, to define the particular kind and limit of exercises to be pursued.

It is important that during the exercises the position of the body, as indicated in each individual description and accompanying illustration, should be strictly adhered to, or the object of the movement will not be attained.

All exercises must be executed carefully, a violent jerk, or sudden shock will either produce a strain of the limb employed,

or possibly throw the apparatus out of order ; no practical good can be derived from hurriedly dragging at the handle, and then as quickly losing hold of it, when the cord is perhaps fully extended. The principle embodied in Gymnastic manœuvres would be thereby entirely subverted, and an absurd and useless waste of time and material established.

It is considered necessary by the greater number of Gymnastic Professors to allow a short interval of rest (about four or five minutes), between the different exercises, for the purpose of permitting the formation of muscular fibre in this intervening period.

The question has often been suggested "When is the best time for taking exercise ?" and may be thus answered : "If practicable, midway, between the respective daily meals; but never immediately after them."

CLASSIFICATION OF EXERCISES.

Contrary to the usually adopted plan, that of commencing with the exercises for the superior extremity of the body, *i. e.*, the head, I have entered at once on a description of those most generally needed, the amount of spinal cases and trunk or general weakness being greatly in the majority over malposition of the upper, or deflections of the lower extremities. I have, therefore, given the prominence to that class most suitable for such infirmities, and in so doing have availed myself of the usual nomenclature in the appellation and descriptive use, as I do not claim for myself a fresh field of action, nor new remedial agents, but simply the power of turning the best means to the best account. My arrangement is, therefore, as follows :—

I.—THE FULCRUM CHEST EXPANDER.

II.—CENTRAL EXERCISES.

These are derived from the middle pulley, and are divided into :—

1. The Arrow Exercise.
2. Upward Extension.
3. Lateral Extension.
4. Lateral Extension and Flexion.
5. Adduction with Extension.
6. Abduction with Extension.
7. Traction and Upward Extension.
8. Upward Arm Rotation.
9. Trunk Rotation with Lateral Extension.
10. Angular Traction.

These Exercises exert an influence over the whole muscles of the trunk and arms.

III.—UPPER EXERCISES.

These are derived from the pulleys at the top of the Gymnasium, to which either the short staff or the loose handles must be attached, and are as follows :—

1. Semi-Rotatory Movement.
2. Inclined Downward Traction.
3. Rotatory Traction.
4. Downward Traction, with Forward Movement of Trunk.

FIG 2A.

FIG 3A.

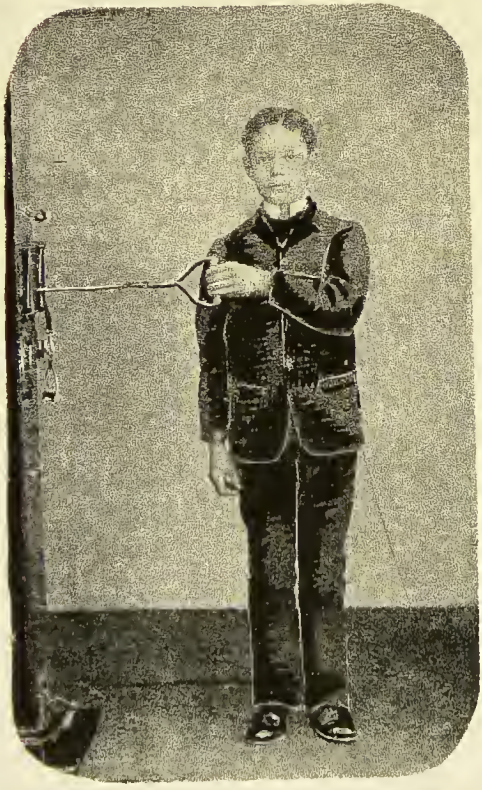

FIG 4A.

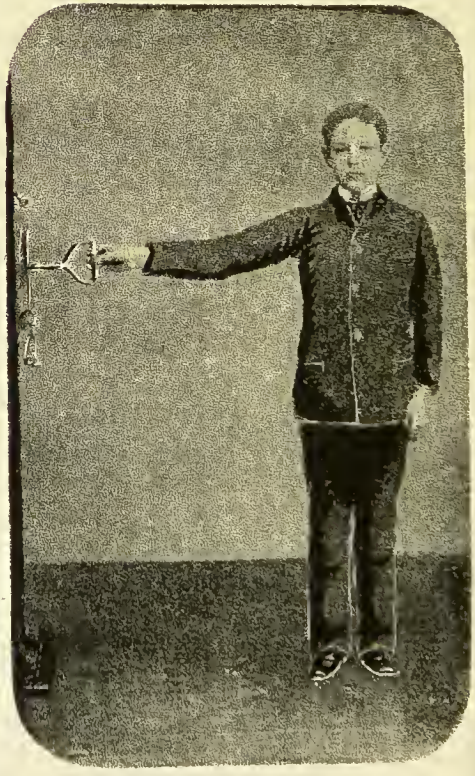

FIG 5A.

LOWER EXERCISES.

These are derived from the lower pulleys :—

1. Back Upward Traction.
2. Upward Erect Traction.
3. Lateral Flexion of Trunk.
4. Lateral Traction.
5. Upward Traction.
6. Horizontal Inclination.
7. Upward Traction Chest Expander.

HEAD EXERCISES.

These are performed by means of the central pulley, with the head strap, which is arranged accordingly :—

1. Lateral Flexion and Extension.
2. Forward and Backward Extension.
3. Rotation.

I.—THE FULCRUM CHEST EXPANDER.

Fig. 2*a*. Plate 2*a*.

The patient in this exercise is placed in front of the Gymnasium (the feet being close together) about 12 inches from the handles of the expander, which distance, after the lapse of a few days, must be increased inch by inch ; the handles are then grasped, the arms being kept *close to the body*, which latter must now be allowed, by its own weight, gradually and slowly to fall forward ; recline a second or two in the position indicated in the illustration, and then slowly withdraw to the erect attitude. Continue this and all the following exercises *a given number of times*, commencing with six, and increase according to the medical practitioner's opinion of the patient's strength, especial care being taken never to tire or overstrain any one set of muscles. In cases of lumbago this exercise has been found of special service, the muscles effected by that painful disorder being particularly influenced by it.

II.—CENTRAL EXERCISES.

1. THE ARROW EXERCISE.

The patient standing in front of the Gymnasium, in the same attitude as if preparing to shoot an arrow from a bow, holds with the *left* hand the fixed handle, and with the *right* the detachable handle, which must be fastened to the centre swivel; then draw the cord gradually till the arm is fully extended, and after a moment's continuance in that position, allow it gently to retract. In commencing the traction, the handle must rest in the four fingers till the arm is nearly extended; it will then of itself pass to the thumb, and so allow the wrist to bring the hand in one straight line with the arm.

2. UPWARD EXTENSION.

Fig. 3*a*. Plate 2*a*.

The patient's back is turned towards the Gymnasium. —Begin by passing the hand behind, grasp the handle, and bring it in front of the body from under the arm (the handle when in front should rest in the hollow, between the thumb and first finger, and be retained so through the exercise), a step must now be taken forward with the right foot, about 18 inches, the toe of the advanced foot being slightly turned out, whilst the knee is kept bent over the foot and the left leg perfectly extended. Let the right arm be thoroughly stretched forward beyond the body, the hand elevated to the height of the chin, and the shoulder advanced; then allow the hand to resume its original place. Reverse the position of the hands and feet, and perform the movement the prescribed number of times.

3. LATERAL EXTENSION.

Fig. 4*a*. Plate 2*a*.

In this exercise the patient is not to face the Gymnasium, but stand sideway, with the right shoulder towards it, keeping the shoulders level throughout, the feet close together, occasionally separated about four inches. Stand firmly at the distance of fourteen inches from the base of the pedestal, with the knees straight, but not stiff. The hand most distant from the Gymnasium, in this instance the left, is passed across the chest, and taking hold of the handle with the fingers, will, by flexing the arm draw it into a position before the right shoulder. Extend the arm very slowly and laterally from the chest until it is perfectly straight. So soon as this extension commences, drop the handle into the hollow between the thumb and first finger, thus affording more power. Finish the exercise by returning to the first position, and repeat the action the appointed number of times. After an interval, reverse the body, and in the same manner exercise the right arm.

---

4. LATERAL FLEXION AND EXTENSION.

Fig. 5*a*. Plate 2*a*.

The position of the patient in this exercise is precisely the same as in Fig. 4*a*, Plate 2*a*, with the exception of the distance from the pedestal being increased to 26 inches. With the hand nearest to the Gymnasium, *i.e.*, the right, take the handle in the fingers, but not grasp it, the arm, of course, being extended; then draw the handle to the centre of the chest, shift it between the first finger and thumb, and pass it across to the left shoulder, extend the arm as much as the position of the body will allow, and let it retract to the starting point. Repeat the movement, employing the hands alternately.

5. ADDUCTION WITH EXTENSION.

The position of the body is precisely identical with that in the last exercise. Grasp the centre handle firmly with the right hand, and with it describe part of the circumference of an imaginary circle, *i.e.*, as great an arc as the fully extended arm will allow. This object is effected by keeping the elbow and wrist perfectly stiff, and the body quite tranquil, no motion being anywhere allowed but at the shoulder joint. A reversion of the movement completes the exercise; the arm, in turning to the starting point, is assisted thereto by the weights, which it only so far resists as to prevent a jerk. Like all other exercises, the right and left arm is alternately used.

---

6. ABDUCTION WITH EXTENSION.

Fig. 6*a*. Plate 3*a*.

Whilst the position in this exercise, with the exception of being nearer the pedestal, is the same as in the one immediately preceding, the action is a reversed one, and brings another set of muscles into play. The left hand crossing the chest possesses itself of the *loose* handle, and extends the cord till the arm is straight, the stiffened elbow and wrist describing a horizontal arc; the traction in this exercise is from both Gymnasium and body; in the preceding it is from the former to the latter. The return of the arm is facilitated by the weights, care again being taken to prevent jerking the limb. The ability to perform this movement is greatly assisted by the right hand holding the fixed handle.

---

7. TRACTION AND UPWARD EXTENSION.

Fig. 7*a*. Plate 3*a*.

The Sideway position (the right arm towards the Gymnasium) must be assumed. Stand firmly on the floor, the feet a little apart and the knees flexible; take hold of the handle with fully

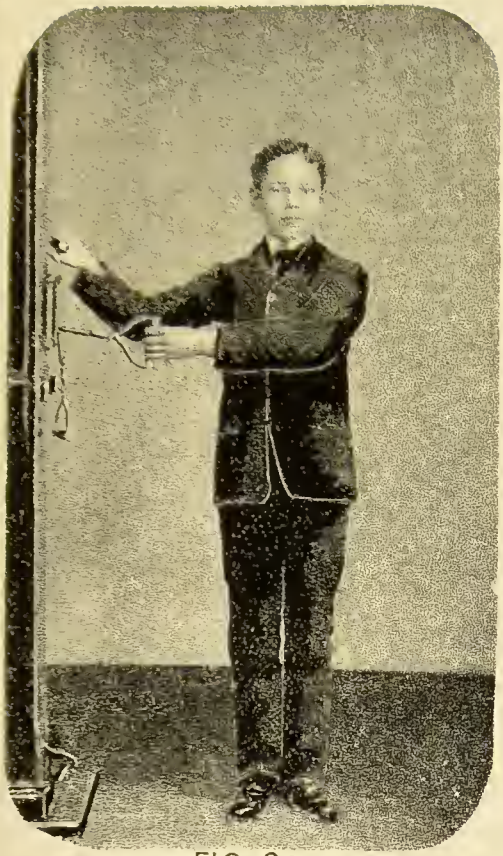

FIG 6A.

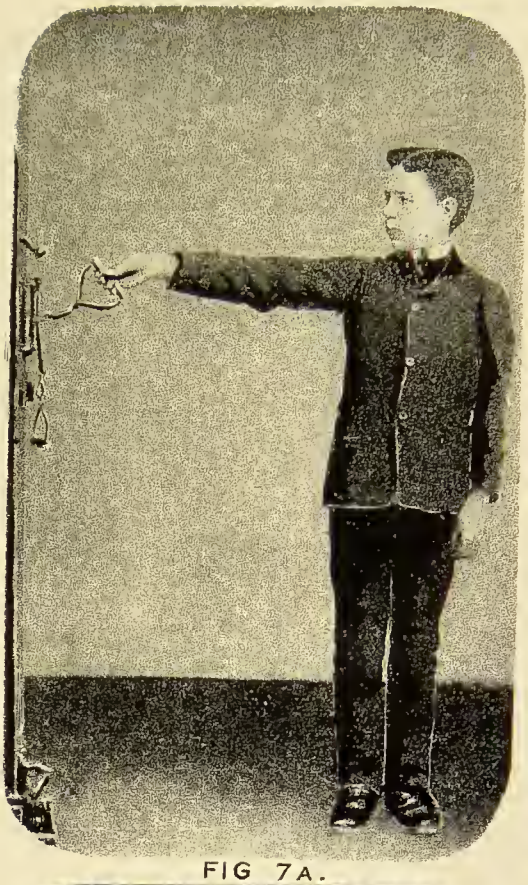

FIG 7A.

FIG 8A.

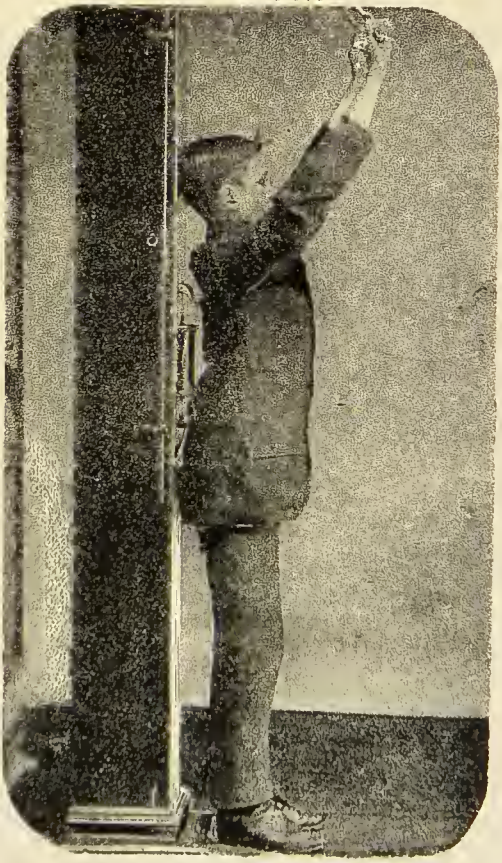

FIG 9A.

extended arm, and bring it straight over the head, not allowing the body to assist by any inclination whatever. Then let the hand resume its commencing point, always doing so very gradually. Alternate this up-and-down movement with the left hand, shifting, of course, the body according to the arm employed.

---

8. UPWARD ARM ROTATION.

Fig. 7*a*. Plate 3*a*.

The commencing position in this is the same as in the last, and the exercise almost similar, the difference being that in this the arm, when it has attained the upward extent over the head, instead of descending vertically, describes a circle to arrive at the starting point; the muscles of the shoulder are brought thus into active use, and the arm performs a perfect revolution in its axis, care being taken that the body should not aid it by inclination or otherwise.

---

9. TRUNK ROTATION WITH LATERAL EXTENSION.

Fig. 8*a*. Plate 3*a*.

The peculiarity of this Exercise consists in the body's participation with the movements of the arm, thereby calling into action the lower muscles of the trunk. The position is the same as in No. 3, Fig. 4*a*, Plate 2*a*, and the movement similar; but, as the arm commences the extension, the body turns with it *from the hips*, the feet being kept perfectly still, thereby enabling the hand to describe the greater portion of a circle; rotate the body with flexion and extension, changing hands alternately.

10. ANGULAR TRACTION.

The vertical rollers on either side of the central pulley, described at page 38, are in this Exercise particularly useful.

The body is placed immediately in front of the pedestal, just so close to it as to allow the passage of the hand only between it and the body, this close proximity preventing any stooping of the head and shoulders which might otherwise occur. The centre handle is then grasped (the cord directed on to the roller corresponding with the hand employed), and the hand and arm fully extended, laterally and horizontally. When the hand has reached this full extension, it should be raised about twelve inches in an upward line, when it will have described a slightly acute angle, and allowed to return in a gentle manner, carefully reversing the movement.

I have confined the number of Central Exercises within the foregoing limit, as I have found them sufficient and efficient for all ordinary purposes. In severe and extraordinary cases I have frequently varied the movements, and added to them others, suggested by the circumstances; but as these instances are rare, I have at present omitted them to avoid prolixity.

II. UPPER EXERCISES.

1. SEMI-ROTATORY MOVEMENT.

Fig. 9*a*. Plate 3*a*.

The short staff having been previously attached to the two upper swivels for the accomplishment of this exercise, the patient must be placed with the back to the pedestal, the head and shoulders coming in contact with it, and thus remaining during

FIG 10A.

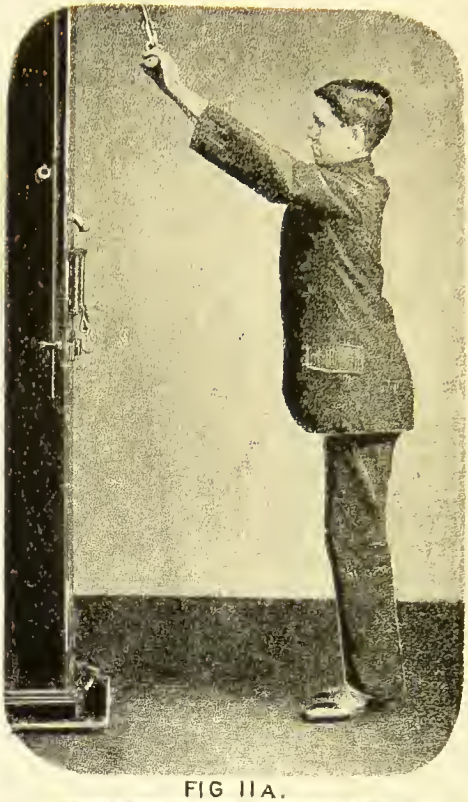

FIG 11A.

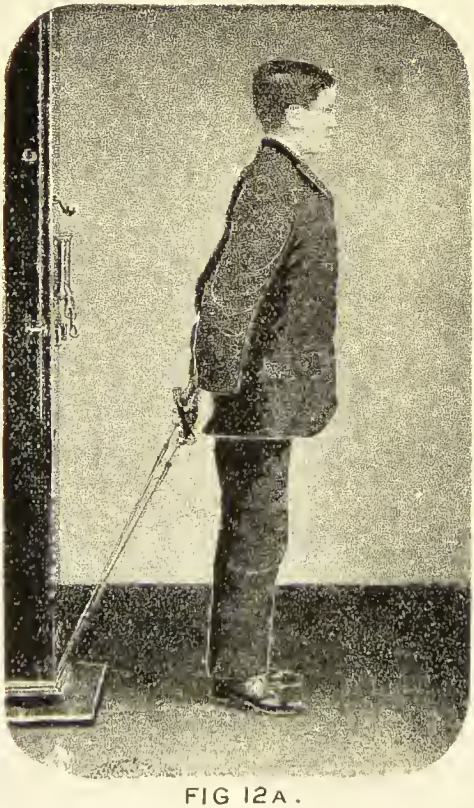

FIG 12A.

FIG 13A.

the whole exercise. The heels should be kept close together, the toes turned out, and the legs quite straight. The arms being fully extended over head, the staff must be grasped by both hands, and brought down in front of the body (the arms remaining perfectly stiff) as low as possible; this effected, the arms must be flexed, and the staff allowed gradually to ascend to its starting point, so as to be again in readiness to re-perform the movement, which very much resembles that of turning a fly-wheel.

---

2. INCLINED DOWNWARD TRACTION.

Fig. 10*a*. Plate 4*a*.

For this exercise, substitute the handles for the staff, and take up a position with the back towards the Gymnasium, the left heel being fixed close to the base of the pedestal, and the right eighteen inches in advance, the heel being opposite the instep of the left foot. The knee of the right leg must be bent, but that of the left perfectly straight; incline the body forward over the advanced leg. *Before* assuming this position, indicated in the illustration, *face* the Gymnasium, lift the arms over the head, take the handles in the fingers, draw them out, and quickly turn the body, which will then be rightly placed. Keep the arms always extended, and bring them down in front of the body, allowing them to ascend in the same way. After several repetitions of this movement, reverse the feet, and continue according to the above directions.

---

3. ROTATORY TRACTION.

This is a variation on the preceding exercise; the arms rotating in the shoulder joint, and in their passage, forward, downwards, backwards, and upwards, completing a circle. This will, at the commencement, be rather difficult, and cannot, perhaps, be very well effected without flexion of the arms; but, after a time, practice will enable the patient to achieve this feat.

4. DOWNWARD TRACTION WITH FORWARD MOVEMENT OF TRUNK.

Fig. 11*a*. Plate 4*a*.

Attach the staff to the upper swivels, and place the patient at the distance of one yard from the pedestal, with the face towards it, the body quite erect, feet close together and knees straight; the staff must then be lightly held with the fingers, the arms being fully extended. Draw down the staff with stiff arms, keeping them so, and bend the body from the hips, till the staff is within eighteen inches of the ground. The hold on it being now somewhat relaxed, allow the weight to draw up the arms, offering to it just so much resistance as will prevent it from *suddenly* ascending, when the arms will be in a position to resume the exercise. Repeat the movement the given number of times.

III. LOWER EXERCISES.

The following class of exercises are performed from the base of the pedestal, with the staff or loose handles, either of which must be employed as specified in the instructions.

---

1. BACK (UPWARD) TRACTION.

Fig. 12*a*. Plate 4*a*.

Attach the staff to the swivels, and place the patient with the back to the pedestal; the heels must be close together and the toes turned out. Keep the upper part of the body well erect, and pass the hands behind it, the arms being held straight. Then allow the knees to flex, so that the staff may be grasped at either extremity with the hands. When this is done, raise the

FIG 14A.

FIG 15A.

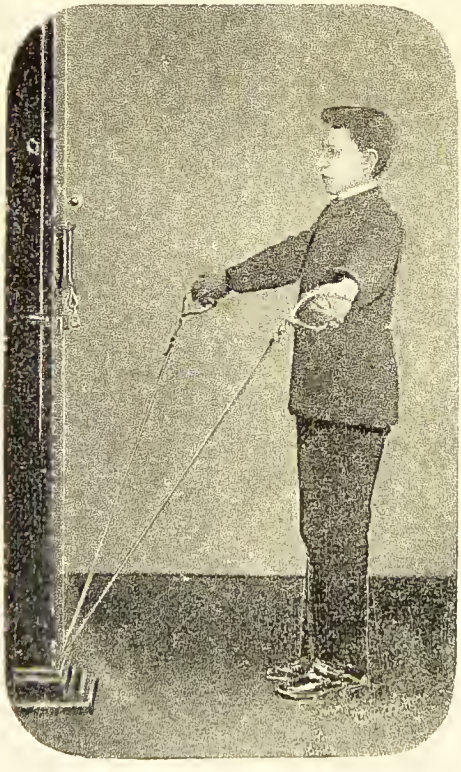

FIG 16A.

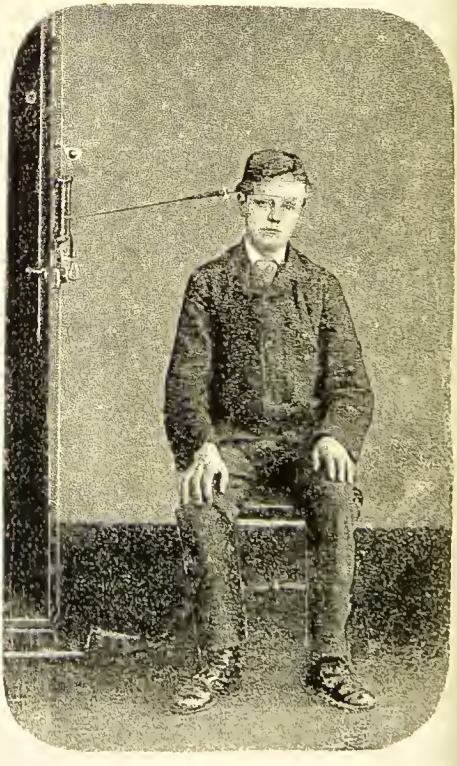

FIG 17A.

body to its perpendicular position, and, in so doing, draw up the staff as indicated in the illustration. Then keep the shoulders well back, and continue the traction as high as possible towards the shoulder blades; hold the hands in that attitude a few seconds, and, finally, allow the staff to descend as low as possible without bending the body.

---

2. UPWARD ERECT TRACTION.

Fig. 13*a*. Plate 4*a*.

In opposition to the last exercise, the patient faces the pedestal, but stands about two feet distant, with the heels touching each other and toes turned out. The body must then be inclined forward, so that the fingers can lightly take hold of the staff at its extremities. The upward traction is first commenced from the loins, and brings the head and shoulders in a line with the hips and feet. The arms then continue it until they are perfectly straightened over the head. In the upward progress of the arms, the staff will have shifted itself from the fingers to the palm of the hand, between the thumb and first finger, and in the retrogressive movement it will, of course, revert to the fingers. The arms should be kept as much straightened, throughout the exercise, as possible.

---

3. LATERAL FLEXION OF TRUNK.

Fig. 14*a*. Plate 5*a*.

The patient must stand tolerably firm, sideways towards the machine, with the feet a little separated, the hand nearest the pedestal grasping the staff in the centre, while the other depends easily.

This exercise is commenced by drawing the staff up to the side by means of flexing the elbow, and continued by bending the body over to the side farthest from the pedestal as much as practicable; then allow the arm to retreat, and follow it with the body to the side nearest the pedestal. After repeating these movements several times (care being taken that the inclination of the body is only from the hips), turn round, and exercise the hitherto idle arm in a similar manner.

---

4. LATERAL TRACTION.

A pad must now be attached to the staff, which is to be placed over the shoulder, one cord passing in front of the chest, the other across the back, the position being the same as in the preceding exercise. The body, in its erect position, resists the weight for a minute, and after that period allows itself to be gradually drawn down by it towards the Gymnasium, flexing the knee nearest to it, and, of course, fully extending the opposite leg. By a gentle effort, return the body to the upright attitude, and incline towards the opposite side, continuing the traction on the weight until the body is inclined as far from the pedestal as practicable. Let the weight now exercise its influence to bring the body erect, in readiness to perform the movement again. After a few repetitions, the padded staff must be transferred to the other shoulder, for the completion of a like number of tractions.

---

5. UPWARD TRACTION.

The patient must in this case face the Gymnasium, standing about three feet from the base, and stooping forward from the hips, take the padded staff on his back, placing it exactly on the top of the shoulder blades. The body must then be slowly drawn up to its full height, and inclined as much backward as

possible, to give full development to the muscles of the back and abdomen. When arrived at this balancing point lessen the bodily resistance to the opposing weight, and permit it to drag the trunk into the horizontally commencing position. A definite number of repetitions complete the Exercise.

---

6. HORIZONTAL INCLINATION.

Fig. 15*a*. Plate 5*a*.

This Exercise is almost identical with that of rowing in a boat, the resisting medium alone being different. The padding must be removed from the staff, and the patient placed on a low hassock, the feet resting against the base of the pedestal, while another hassock, double the height of that forming the seat, must be put behind at such a distance as to receive the head and shoulders when the patient is fully reclined backwards. Bend the body forward over the legs, stretch out the arms and grasp the staff at its extremities. Press the feet against the pedestal and bring the body well back, till the head and shoulders rest on the hassock placed for that purpose. Keep the elbows close to each side of the body, flex them, and bring the hands as near the chin as can be. Repeat the movement, occasionally using one hand only, which must in that case hold the staff in the centre.

---

7. UPWARD TRACTION CHEST EXPANDER.

Fig. 16*a*. Plate 5*a*.

This exercise, though classed among those of the "Lower" series, may be performed from the "Upper" swivels also, the result being that two separate Exercises are formed, that from the "Upper" being a *downward* traction, while that from the "Lower,"

which is illustrated by Fig. 16*a*, is an *upward* traction, each differently affecting the muscles employed, but identical in effect, viz., the expansion of the chest. Whichever form is used the patient's position should be from four to five feet from the pedestal, and facing it; the body must be kept erect, but not stiff; the heels together and toes slightly turned outward, as indicated in the annexed illustration. Previously lengthen the cords emanating from the base of the pedestal by attaching the webbing straps, and bring the arms forward without bending them. The handles are then taken hold of by the tips of the fingers, and the cords slowly drawn out on either side of the body until the hands are level with the shoulders, and as far back as the shoulder joints will permit. This extension accomplished, allow a gentle retrogression, and repeat the exercise a limited number of times.

In the "downward traction" the webbing must be attached to the top swivels. The position of the patient remains the same, with the exception that the arms are extended upward on an incline, so as to be in a line with the upper swivels, and the movement is the reverse of the previous one. After taking the handles with the fingers they are gradually brought down until they reach the level of the shoulders, at the same time throwing the shoulders back as much as possible. It is very essential that in either of these exercises the arms should momentarily stop when they have raised or depressed the cords to the shoulders, so as to sustain the extension, and after that pause allow them to retract.

EXERCISES FOR THE HEAD.

The species of deflection for which the following Exercises are specially needed is, happily, rare and uniform in character, so that comparatively few movements are required. When it is desirable to make use of gymnastic help, a proper band is supplied, which encircles the head and is secured on by straps. It is fitted with eye loops to receive the swivel terminating the

cord that passes over the central pulley, the eye loops being so arranged as to render the head piece available for any exercise. The opposing weight generally requires reducing as there is not so much power in the head to move or drag it as exists in the arms. The patient's own feeling will be the best index as to weight, for should the traction prove difficult the power must, of course, be lessened. I give but three varieties of Exercises, and they will be found generally sufficient for any head malposition.

---

1. LATERAL FLEXION AND EXTENSION.

Fig. 17*a*. Plate 5*a*.

The patient must be placed in a chair with the side on which the contraction exists farthest from the Gymnasium, and fix the eyes on some object level with the head (the head being well kept up and properly placed in the padded band); incline it very gently to the shoulder nearest the pedestal, and then allow it to retreat. If the contraction be severe, the head cannot be expected to yield very much from the first few lessons, but the extent of the traction should be daily noticed, and, imperceptibly, the head will be found more easily able to advance to the opposite shoulder. Where habit has given an inelegant appearance to the carriage of the head, the exercise must be employed with the right and left sides alternately towards the pedestal.

---

2. FORWARD AND BACKWARD EXTENSION.

The patient must be placed in a chair facing the pedestal, and having the head-piece properly adjusted, allow the weight to draw the head downward, when, by an effort on his part, he must gently incline it as much backward as practicable. After repeating this exercise a certain number of times, he must alter his position, and sitting with his back to the pedestal, continue, as before, an alternate elevation and depression of the head, the

difference of the two positions being, that in the former his head will be drawn forward and downward; in the latter, upward and backward, thus affecting the *whole* muscles of the neck, and powerfully developing those which are either the subjects of weakness or loss of volume. The patient must very carefully prevent the body participating in the movement.

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3. ROTATION.

The patient assumes a sitting attitude, with the side of the body towards the pedestal, the head-piece comfortably arranged, and the body held perfectly still and upright. The exercise consists in turning the head first over one shoulder then the other. As the traction is from the apparatus, the sides must be changed, otherwise an unequal influence will be exercised on the two sets of muscles; but this is provided no particular contraction exists. In the latter case, it is highly important that the medical attendant's directions as to the kind and duration of movement should be obtained.

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